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ROYAL SOCIETY

OF

EDINBURGH.

VOL. XIX. PART II.

CONTAINING THE

GENERAL RESULTS OF THE MAKERSTOUN MAGNETICAL AND METEOROLOGICAL OBSERVATIONS, WITH DETAILED TABLES OF RESULTS

FOR

1845 AND 1846.

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GENERAL RESULTS

OF THE

OBSERVATIONS

IN

MAGNETISM AND METEOROLOGY,

MADE AT

MAKERSTOUN IN SCOTLAND,

IN THE OBSERVATORY OF

GENERAL SIR THOMAS MAKDOUGALL BRISBANE, BART.,

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AND CORRESPONDING MEMBER OF THE INSTITUTE OF FRANCE,

WITH DETAILED TABLES OF RESULTS

FOR THE YEARS 1845 AND 1846.

ORMING VOL. IX. PART II. OF THE TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH.

BY JOHN ALLAN BROUN, ESQ.,

DIRECTOR OF THE OBSERVATORY.

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Mean Westerly Declination and its secular change.—The mean declination for each month in each year, from August 1841 till November 1849, is given in Table I.; it diminishes generally from month to month; in the mid-summer months, however, it frequently increases.

4. The mean declination for each year, with the yearly value of secular change and its mean value for each four years are given in Table 2: the mean for 1841 has been deduced in assuming the change from 1841 to 1842 the same as that obtained from a comparison of the observations for four months of 1841 with the observations for the corresponding months of 1842; and the mean for 1849 has been found similarly from the comparison of the observations in the first eleven months of the years 1848 and 1849.

5. The mean yearly value of the secular change from the last column of Table 2 = 5′·92. Some irregularity appears in the values of the secular change from year to year, especially in those for the years 1846–1849, compared with the values for the preceding years; this marked difference, it is conceived, is not due to instrumental error, because no such amount of torsion in the suspension thread of the declination magnet has existed to produce it; and the observations of the bifilar and balance magnetometers indicate a similar variation in the value of the secular change for the year 1847–8. In that year, great magnetic convulsions occurred, the effects of which seem to have extended into the years 1848–9.

6. The last column of Table 2 appears to exhibit the *variation* of the yearly value of secular change; its increase as the needle moves farther from its greatest westerly position. Between 1842 and 1847 the secular motion from year to year is moderately equable. This is not the case with the motion from month to month, which is occasionally retrograde. We are induced to conclude, therefore, either that the secular motion varies from month to month, while nearly constant from year to year; or that the secular motion being uniform from month to month other motions are superposed: in either case, by reducing the mean positions for the several months to one epoch, the residual variations will be more clearly exposed, and it may be determined whether they obey any law related to season. Since we are aware that the secular motion for the same place is sometimes eastwards and sometimes westwards, it does not appear necessary to form any other hypothesis than that the secular change is the excess of the motions in one direction over those in the other, and to determine whether the amounts and directions of motion have any relation to season.

TABLE 2.—Yearly Means of Magnetic Declination and the Secular Change.

Year.	Mean W. Declination.	Secular Change.	
		Each Year.	Mean of 4 Years.
	° ′	′	′
1841	25 33·68		
1842	25 28·45	5·23	
1843	25 22·85	5·60	
1844	25 17·06	5·79	
1845	25 11·32	5·74	5·59
1846	25 5·97	5·35	5·62
1847	24 59·65	6·32	5·80
1848	24 51·81	7·84	6·31
1849	24 45·12	6·69	6·30

7. *Annual Period of Magnetic Declination.*—In the discussions for 1844 the apparent law of annual variation has been offered with some confidence, and that chiefly because of the considerable agreement of four years' observations where the variations were of the smallest order. In the means for 1843–6, the proportional parts of the yearly secular change being eliminated, the variation of the monthly means is under *one minute*: since the variations from month to month are so small, it is evident that, in order to detect any relation to season, the greatest care must be taken to avoid all instrumental errors; for this reason it appears proper to consider at first the results from those years only (1843–6), during which a sufficient number of daily observations were made to give the monthly means without any considerable error. The means for the first of these years (1843) are affected to some extent with torsion of the suspension thread, which broke gradually in June: on which account the mean of May and July has been substituted for June in Table 3.

TABLE 3.—Monthly Variations of Magnetic Declination free from Regular Secular Change.

Month.	1843.	1844.	1845.	1846.	Mean of 1843 and 1844.	Mean of 1845 and 1846.	Mean of 4 Years, 1843–6.	1847, Corrected by Maker-stoun.	1847, Corrected by Green-wich.	1848.	1849.	Mean of 3 Years, 1847-9.
	′	′	′	′	′	′	′	′	′	′	′	′
January	+0·15	+0·90	+0·13	+0·34	+0·53	+0·24	+0·38	−0·38	−0·44	+0·51	−0·34	−0·08
February	+0·04	−0·29	+0·40	−0·07	−0·12	+0·17	+0·02	+0·05	+0·33	−0·13	+0·06	+0·04
March	−0·04	−0·90	+0·14	−0·21	−0·46	−0·03	−0·25	+0·74	+0·75	+0·68	+0·24	+0·55
April	−0·12	+0·02	−1·18	−0·50	−0·04	−0·84	−0·44	+1·24	+1·17	+0·31	−0·25	+0·42
May	+0·08	−0·48	−0·69	−0·67	−0·19	−0·68	−0·44	0·00	+0·18	+0·42	+0·21	+0·24
June	+0·60	−0·72	−0·34	−0·09	−0·05	−0·21	−0·14	−0·28	−0·20	−0·69	+0·41	−0·17
July	+1·12	−0·31	+0·02	+0·35	+0·41	+0·19	+0·30	+0·18	+0·10	+0·09	−0·74	−0·17
August	+0·34	+1·02	+0·05	+0·37	+0·69	+0·21	+0·45	+0·40	+0·27	−0·32	−0·60	−0·20
September	−0·59	+1·24	+0·25	+0·63	+0·33	+0·44	+0·38	−0·88	−1·03	−1·15	−1·01	−1·04
October	+0·72	+0·11	+1·12	+0·25	+0·42	+0·69	+0·55	−0·83	−0·25	−0·38	+0·10	−0·27
November	−1·46	−0·43	+0·41	−0·13	−0·94	+0·14	−0·40	−0·01	−0·48	−0·19	+0·92	+0·16
December	−0·87	−0·21	−0·34	−0·25	−0·53	−0·29	−0·41	−0·28	−0·36	+0·84	[+1·06]	+0·53

8. Table 3 has been formed from Table 1 in the following manner; the monthly means for 1843, 4, 5, and 6 were reduced for mean secular change to January of their respective years by the correction

$$M_n + 0'{\cdot}48 \times n$$

where M_n is the mean for the nth month after January, and 0′·48 is the approximate mean value of secular change for one month. If m be the mean of the twelve resulting quantities for any year, the numbers μ in Table 3 are obtained by the formula

$$\mu_n = M_n + 0'{\cdot}48 \times n - m$$

The numbers for 1847, 8, and 9, were obtained in a similar manner; 0′·63 being used instead of 0′·48 for 1847, 0′·62 for 1848, and 0′·56 for 1849; the value of the secular change for 1847 has been obtained by comparing the last six months of 1846 with the corresponding months of 1847, and the first six of 1847 with the corresponding months of 1848; that for 1848 was obtained similarly. The means for 1841–2 are not inserted, as they were too much affected by torsion and broken suspension-threads to be of use in this investigation.

9. The interpolated epochs of maximum and minimum, from the mean of 4 years in column 8 of Table 3, are,—

A minimum of westerly declination in the end of April;
A maximum ..... in September;
A minimum ..... in the beginning of December;
A maximum ..... in the end of January.

This result is shewn with considerable fidelity in each of the four years; the greatest variations from it can be traced to torsion of the suspension thread removed at the particular epochs: the means for 1846 give accurately the result of the means for the other three years.

10. The year 1847 was one of great magnetic disturbance, and as only 5 observations were made daily, the effect of the disturbed observations on the monthly means is the more considerable. Thinking it possible that corrections for the 5 observations might be obtained with greater accuracy from complete series made elsewhere during the *same* year, I applied to Mr AIRY, the Astronomer-Royal, for this end. I have to thank him for furnishing me with corrections obtained from the Greenwich Observations for that year. These corrections having been applied, the resulting variations, obtained as previously indicated, will be found column 10 of Table 3; they give almost exactly the same result as the quantities corrected by the Makerstoun Observations for 1844 and 1845: according to both, there is a slight maximum exhibited in August, but otherwise the result differs considerably from that given by the preceding years. The observations for 1848 and 1849 on the whole indicate a result not differing greatly from that for 1847; and when we examine the mean for the 3 years 1847–9, as in the last column of Table 3 (where the mean of columns 9 and 10 has been taken for 1847), we find a similar but more regular result. The value of the conclusions from the observations for 1843–6 depends upon the consistency of the partial results and the regularity of the secular motion from year to year: when it is pointed out that the means for 1847, 8, and 9, are deduced from but few daily observations, it should

also be stated as very probable, that the errors in the corrections employed (to reduce the means obtained to those derivable from complete series) are insufficient to account for the differences of these variations from those for the preceding years; as is evident for the year 1847, corrected by two very different methods. The only evident explanation remaining is to be found in the varying secular change for these years; and it does not appear at all improbable that the difference is connected with this variation. It has been shewn that the annual period has appeared inverted when the sign of the secular motion was opposite; it is the most remarkable fact in connection with the differences of the results for the two periods 1843–6 and 1847–9 that they are *exactly the inverse of each other* (see columns 8 and 13 of Table 3): the completeness of the opposition in the double maxima and minima appears too curious to be accidental. If the latter result be a true exposition of the annual law for these 3 years, it will follow that the inversal of the law observed at the same time with an opposite secular motion is not necessarily a consequence of that opposition.*

Differences of the Daily Means of Declination from the Means for the corresponding Months.—The discussion for 1844 will be found in the volume for that year, page 332, the results for 1845 and 1846 are obtained from Tables I. and LI. of this volume.

TABLE 4.—Means of the Westerly and Easterly Departures of the Daily Mean Magnetic Declination from the Monthly Means, with their Differences.

Month.	Mean Westerly Departures.				Mean Easterly Departures.				Diff. of Mean Depart.	Mean Departures, without reference to Direction.				
	1844.	1845.	1846.	Mean.	1844.	1845.	1846.	Mean.		1844.	1845.	1846.	Means of each Month.	3 Months.
	′	′	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·48	0·59	0·51	0·53	0·69	1·00	0·48	0·72	−0·29	0·56	0·74	0·49	0·60	0·64
Feb.	0·70	0·64	0·92	0·75	0·75	0·54	0·92	0·74	+0·01	0·72	0·59	0·92	0·74	0·63
Mar.	0·35	0·43	0·80	0·53	0·41	0·80	0·59	0·60	−0·07	0·38	0·56	0·68	0·54	0·64
April	0·77	0·53	0·80	0·70	0·41	1·00	0·59	0·67	+0·03	0·53	0·70	0·68	0·64	0·59
May	0·44	0·58	0·83	0·62	0·65	0·54	0·61	0·60	+0·02	0·53	0·56	0·70	0·60	0·59
June	0·40	0·34	0·88	0·54	0·37	0·37	0·88	0·54	0·00	0·38	0·35	0·88	0·54	0·58
July	0·61	0·45	0·94	0·67	0·49	0·31	0·87	0·56	+0·11	0·54	0·37	0·90	0·60	0·64
Aug.	0·70	0·76	1·34	0·93	0·41	0·65	0·98	0·68	+0·25	0·52	0·70	1·13	0·78	0·75
Sept.	0·87	0·56	1·35	0·93	0·58	0·48	1·35	0·80	+0·13	0·70	0·52	1·35	0·86	0·80
Oct.	1·31	0·55	1·19	1·02	0·66	0·60	0·60	0·62	+0·40	0·87	0·58	0·79	0·75	0·80
Nov.	0·40	1·05	0·91	0·79	0·63	1·14	0·71	0·83	−0·04	0·49	1·09	0·80	0·79	0·70
Dec.	0·38	0·64	0·52	0·51	0·72	0·60	0·65	0·66	−0·15	0·50	0·62	0·58	0·57	0·60

11. The conclusions from this Table are:—

1*st*, The daily mean declination departs farthest to the west of the monthly mean in August, September, and October, on the average about 0′·96: the average departure for each three of the remaining nine months is nearly constant; about 0′·60.

* I have pointed out in a paper on the magnetic declination read before the Royal Society of Edinburgh, May 3, 1847, that the annual variation is inverted when the secular motion has an opposite sign. M. ARAGO made an indistinct approximation to this fact in comparing the observations of CASSINI with those of BOWDITCH (1810), *Annales de Chimie*, xvi., p. 66. M. KAEMTZ also alludes to the fact in comparing CASSINI's observations with observations by M. KUPFFER and M. GAUSS (*Kämtz Lehrbuch*, iii., 426). In both cases the fewness of the latest observations are considered to render the conclusion doubtful. Dr LLOYD has recently distinctly stated the fact from the comparison of CASSINI's observations with his own (*Trans. Roy. Ir. Ac.* xxii., May 1846). The following is from the abstract of my paper:—"The *annual period* of magnetic declination consists of a double oscillation, having nearly the following epochs of maxima and minima:—

"A max. Jan. 30. The min. April 30. The max. Sept. 10. A min. Dec. 10.

"The author examines CASSINI's observations (1783–7). Although they confirm this law to some extent, it is not conceived that they can be trusted for such a determination. The author also verifies his result by grouping a large mass of modern observations. The observations at Washington [1840–42], and Toronto [1841–42], [discussed in the paper] with other facts, prove that the oscillation is inverted, when the secular motion of the needle has an opposite sign; and Colonel BEAUFOY's observations [1817–20] seem to prove, that when the secular motion is zero, the annual period is a combination of the oscillations for a positive and negative secular motion." (*Proceedings Roy. Soc. Edin.* May 1847.)

2*d*, The daily mean declination departs farthest to the east of the monthly mean in the months from August to February; the means for 1844 and 1845 (which are most to be depended on for this investigation) indicate November, December, and January, as the three months with the greatest average departure to the east, about 0′·80: the least mean departures to the east occur in June and July; the average being 0′·55, or, by the means for 1844 and 1845, 0′·38.

3*d*, The mean westerly departures are most in excess of the mean easterly departures in August, September, and October, and the latter are most in excess of the former in December and January.

4*th*, The mean departures, without reference to direction, are greatest in August, September, and October; the average being 0′·80: they are least in April, May, and June; the average is 0′·60 nearly, the means of each three months in the last column of Table 4 being under consideration. This result was generalized in the volume for 1844, p. 332, as follows: "The average difference of the daily means from the monthly means in 1844, was a minimum when the mean westerly declination was least, and a maximum when it was greatest."

5*th*, The mean departure of daily mean declination from the monthly means for 1844 = 0′·56
.....1845 = 0′·62
.....1846 = 0′·82
..... 3 years = 0′·67

The mean for 1846 is probably too high, owing to the incompleteness of the diurnal series of observations.

Annual Variation of the Diurnal Ranges of Magnetic Declination.—The diurnal range of motion of the declination magnet varies from month to month: the following Table contains the mean of all the diurnal ranges for each month, as deduced from the usual daily observations: the means for 1844 and 1845 only are comparable with each other.

TABLE 5.—Mean Diurnal Range of Magnetic Declination, as deduced from the Ordinary Daily Observations.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	′	′	′	′	′	′	′	′	′	′	′	′	′
1843	5·66	10·09	10·12	12·38	11·00	12·13	12·30	11·78	12·67	9·65	5·85	7·63	10·10
1844	9·00	10·28	16·21	15·88	13·48	12·41	12·36	14·02	15·22	15·69	15·91	11·22	13·47
1845	13·98	12·98	14·20	16·57	14·07	13·77	13·09	16·65	16·66	13·51	10·98	10·91	13·95
1846	9·10	9·21	13·70	15·83	14·70	13·60	14·69	14·89	17·03	13·81	10·31	8·16	12·92
1843 1846	7·38	9·65	11·91	14·10	12·85	12·86	13·50	13·34	14·85	11·73	8·08	7·90	11·51
1844 1845	11·49	11·63	15·20	16·22	13·78	13·09	12·72	15·33	15·94	14·60	13·44	11·06	13·71
Mean of all	9·43	10·64	13·55	15·16	13·31	12·97	13·11	14·33	15·39	13·16	10·76	9·48	12·61

12. From the means for 1844 and 1845 in Table 5 we find, that the mean diurnal range of the hourly observations is greatest in the months of March and April (= 15′·70), and in the months of August and September (= 15′·68); that it is least in the months of December and January (= 11′·27), and in the months of June and July (= 12′·90). This result may be stated generally thus:—The angle, including the diurnal oscillations of the declination magnet, is greatest immediately after the vernal and before the autumnal equinox, and it is least at the winter and at the summer solstices. The means from the incomplete diurnal series of 1843 and 1846 indicate the same law. The quantities given in Table 5 are obtained from the ordinary daily observations, and while they are sufficiently comparative to indicate the variation of range with season, the daily observations are in no year sufficiently numerous to give the absolute diurnal ranges: in 1844 so careful a watch was kept over the smallest variations, and so many additional observations were made, as to render it probable, that Table LX. for 1844, p. 400, contains very nearly the absolute ranges for all the three magnetometers: a similar remark will apply to Table L., p. 28 of this volume, for 1845, although not to the same

extent; the smaller disturbances not having been observed with the same completeness in that year. The mean diurnal ranges for each month from these two Tables are as follow:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1844,	11′·63	13′·63	19′·36	19′·10	14′·83	12′·60	13′·36	16′·58	17′·74	19′·26	19′·66	12′·95	15′·89
1845,	17′·81	15′·31	16′·52	17′·01	14′·67	13′·82	13′·72	17′·79	18′·20	14′·48	12′·64	15′·01	15′·58
Mean,	14′·72	14′·47	17′·94	18′·05	14′·75	13′·21	13′·54	17′·18	17′·97	16′·87	16′·15	13′·98	15′·74

These means give the same law of variation as that already found from Table 5, but the values are considerably higher. From the means for both years we may conclude, that the mean angle, including the diurnal oscillations in years of *moderate* disturbance at Makerstoun, is about 18′ at the equinoxes, about 14′ at the solstices, and about 16′ for the whole year.

Annual Variation of the Ranges of the Monthly Mean Diurnal Variation.—We have considered above the annual variation of the mean ranges for each *day*, we now give in Table 6 the ranges of the mean diurnal variation for each *month*. The first four lines contain the diurnal ranges of the means of all the regular daily observations made in each month; and, as in Table 5, only 1844 and 1845 are comparable with each other: the last line contains the range of the hourly means for each month, as deduced from the observations for the 4 years given in Table 12.

13. From the last line of Table 6 it appears that when a sufficient number of observations is employed, the range of the mean diurnal variation is nearly constant for the six months, April to September, being on the whole rather larger for the first three than for the last three of that half-year: the mean range for the whole six months is about 11′·0. The range is nearly of equal value for pairs of the remaining six months, namely, for March and October (=9′·2); for February and November (=7′·3); and for January and December (=5′·9).

TABLE 6.—Ranges of the Mean Diurnal Variation of Magnetic Declination.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	′	′	′	′	′	′	′	′	′	′	′	′	′
1843	4·92	8·35	7·93	10·52	9·93	11·14	9·95	10·83	10·75	7·90	4·63	5·73	7·54
1844	5·26	6·36	9·94	10·20	8·96	11·05	10·06	10·31	9·95	10·94	9·28	5·96	7·67
1845	6·95	7·31	9·92	13·08	12·42	12·52	10·86	12·67	10·53	9·42	7·50	6·43	8·40
1846	6·54	6·05	10·56	12·58	12·79	11·41	11·94	10·62	11·99	9·24	8·67	5·77	8·52
Mean of all	5·85	7·11	9·28	11·29	11·02	11·61	10·60	10·83	10·45	9·50	7·55	6·02	8·03

14. When we examine the range for each month of the mean diurnal variation as deduced from any single year's observations, we observe a similar result to that obtained from the means of the diurnal ranges (Table 5); namely, that the range is, on the whole, greater for the months near the equinoxes than for those near the summer solstice; but as we combine a larger number of observations the difference gradually disappears, till (as we see in the mean of four years' observations, Table 6) the only difference appears in the slightly greater range for the months immediately before the summer solstice than for those immediately after it. The difference betwixt the two results is, therefore, in all probability, due to irregular causes, which shift the epochs of the extreme positions of the magnet. That this is the case will be rendered nearly evident by the ranges of the diurnal variation as deduced from the 17 days' observations with least irregular disturbance (see 1844, p. 339, and p. 5 of this volume); they are as follow,

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3′·43	4′·54	7′·81	11′·55	9′·66	11′·41	11′·11	11′·18	9′·64	7′·70	5′·31	4′·11

These, with the exception of the range for May, indicate generally the constancy of the regular diurnal range in the months from April till August. The exception of May is easily explained by the fewness of the observations, and the method by which the observations were selected (see volume for 1844, p. 339).

15. Since, then, the means of the diurnal ranges differ from the diurnal ranges of the means, chiefly because of irregular disturbing causes which shift the epochs of the extremes, the differences of the results will give some measure of these disturbances. Taking the differences betwixt the last line of Table 5, and the last of Table 6, we have,

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3′·58	3′·53	4′·27	3′·87	2′·29	1′·36	2′·51	3′·50	4′·94	3′·66	3′·21	3′·46

The difference is greater for March and September than for the winter months, and it is least for June. From this then we conclude (as in the volume for 1844, p. 334) that those irregular disturbances which render the mean diurnal range greater than the range of the mean diurnal variation, have their maximum effect about the equinoxes, and their minimum at the summer solstice. We are still ignorant of the law of disturbances as affecting the position of the declination magnet at all portions of its diurnal motion; to determine this, we may consider the differences of the positions of the magnet at each hour, from its mean position at the same hour for each month.

Annual Variation of the Mean Difference of a Single Observation of Magnetic Declination from the Monthly Mean at the corresponding Hour.—These differences have been obtained for the years 1844 and 1845 only, and the means for each month (from Table XIV., 1844, p. 346; and Table XIII., p. 8 of this volume) are as follow :—

TABLE 7.—Mean Difference of a Single Observation of Magnetic Declination from (1) the Hourly Means of all the Observations, and from (2) the Hourly Means of Observations on Days selected free from disturbance.

Series.	Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
		′	′	′	′	′	′	′	′	′	′	′	′	′
1	1844	1·34	1·40	2·22	1·87	1·60	1·12	1·43	1·71	1·93	2·26	2·30	1·40	1·71
	1845	2·02	1·82	1·76	1·63	1·46	1·20	1·41	1·86	2·06	1·66	1·75	1·63	1·69
	Mean	1·68	1·61	1·99	1·75	1·53	1·16	1·42	1·78	1·99	1·96	2·02	1·51	1·70
2	1844	1·31	1·42	2·15	1·90	1·63	1·18	1·51	1·77	1·88	2·15	2·15	1·34	1·70
	1845	2·00	1·72	1·87	1·56	1·52	1·18	1·40	1·88	2·11	1·58	1·78	1·55	1·68
	Mean	1·65	1·57	2·01	1·73	1·57	1·18	1·45	1·82	1·99	1·86	1·96	1·44	1·69

16. The mean differences from both series give nearly the same result, which is, on the whole, similar to that deduced from the diurnal ranges; it may be stated thus;—the mean departure of the declination magnet from its normal position for any hour is greatest near the equinoxes, and least at the summer solstice. When we examine the means for the separate years, we find that those for 1844 give the result with considerable distinctness, the chief difference consisting in the occurrence of the autumnal maximum in October and November; in 1845, on the contrary, the spring maximum is ill defined at best (as in the 2d series,) while January is a month of considerable disturbance. It appears evident that two years' observations are too few to exhibit a law of this character free from all irregularity. The year 1844 appears to have been remarkably adapted for exhibiting all the usual laws of magnetic and meteorological variation; it is on this account, that it will be found generally in these discussions, that the combination of another year's observations, does not serve to make the results already obtained in the volume for 1844 more regular.

Annual Variation of the Number *of Observations of the Magnetic Declination which were Positive (West) of the Monthly Means for the Corresponding Hours.*—The following Table contains the numbers for each month of 1844 and 1845, with reference (1) to the hourly means of all the observations, and (2) to the hourly means of days selected free from irregular disturbance.

TABLE 8.—Number of Observations of Magnetic Declination in 100 to the West of their Hourly Means as obtained (1) from all the Hourly Observations, and (2) from those for Selected Days.

Series.	Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1	1844	52·7	51·8	51·4	48·4	49·7	52·8	50·0	49·9	53·0	46·0	48·9	55·3	50·8
	1845	54·5	53·0	54·6	54·6	53·2	47·8	49·2	51·9	52·1	47·8	48·0	51·2	51·5
	Mean	53·6	52·4	53·0	51·5	51·4	50·3	49·6	50·9	52·5	46·9	48·4	53·3	51·2
2	1844	51·5	55·3	59·8	49·5	51·1	52·2	45·5	50·8	54·7	47·2	58·0	60·4	53·0
	1845	62·2	55·4	58·8	61·2	45·7	46·7	48·0	46·8	48·2	53·9	50·0	50·3	52·3
	Mean	56·8	55·4	59·3	55·3	48·4	49·4	46·8	48·8	51·4	50·6	54·0	55·4	52·6

17. From the first series, the number of observations to the west of the monthly means for the corresponding hours was greatest in the 4 months December to March, there being on an average 6 more to the west than to the east in 100: the number was least in the months of October and November, there being on an average 7 less to the west than to the east in 100. July is the only other month, in the mean of the two years, for which the number of observations to the west of the mean was greater, than the number to the east. The number for each of the months from April till September varies little.

18. From the second series, for which the mean hourly position is deduced from days selected as nearly free from disturbance, the number of observations to the west of the hourly means was greatest in the 6 months from November to April, there being an average of 12 observations in 100 more to the west than to the east; in the remaining 6 months, May to October, there is an average of about 2 less to the west than to the east.

The number of observations to the west of the hourly means (whether these are obtained from all the observations, or from the undisturbed observations only) is greatest about the months December to March.

19. By both series, each year shews more observations to the west than to the east of the hourly mean positions, however obtained; so that the greatest *departures* from the mean position are to the east, the direction of the secular motion: the 2d series shews this fact most distinctly, as might be expected, since the mean positions are nearly unaffected by disturbance.

20. *Annual Variation of the Probable Error of an Observation of Magnetic Declination from the Monthly Mean for the corresponding Hour.*—It has been already shewn in the volume for 1844, p. 351, that the probable error cannot be deduced on the assumption that the differences from the mean position are analogous to the errors in the observation of a constant quantity, since that assumption is inaccurate; the differences do not occur equally to the east and west of the mean, as is shewn in the following discussion; nor is the number occurring within certain limits satisfied by the usual function of the errors obtained from the calculus of probabilities, as will be found from Table XIX., p. 352, 1844, and Table XVI., p. 10 of this volume. In consequence, a graphic interpolation has been employed to determine the probable error, that is to say, the departure from the hourly mean position, for which there were as many observations with a greater, as there were with a less departure; these, deduced from the two tables last referred to, for each month are:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	0′·93	0′·94	1′·35	1′·20	1′·16	0′·78	1′·04	1′·20	1′·36	1′·58	1′·51	0′·90	1′·16
1845,	1′·38	1′·25	1′·24	1′·08	1′·08	0′·91	1′·05	1′·35	1′·56	1′·14	1′·27	1′·09	1′·20
Mean,	1′·15	1′·09	1′·29	1′·14	1′·12	0′·84	1′·04	1′·27	1′·46	1′·36	1′·39	0′·99	1′·18

These numbers on the whole follow the same law as the mean difference: The probable error of an observation of magnetic declination from the monthly mean of the corresponding hour (without reference to which hour) is least in June (=0′·84) and in December (=0′·99), and it is greatest in September (=1′·46) of the autumn months, and in March (=1′·24) of the spring months. The remarks already made in the case of the annual variation of the mean disturbance apply equally here, see No. 16.

MONTHLY VARIATIONS FOR THE MAGNETIC DECLINATION.

TABLE 9.—Mean Variations of Westerly Declination free from Regular Secular Change, with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	′	′	′	′	′	d. d.	′	′	′	′	′
14—16	+0·24	−0·04	+0·06	+0·32	+0·15	27— 1	+0·25	+0·19	+0·07	+0·35	+0·22
17—20	+0·42	+0·24	−0·08	+0·09	+0·17	2— 5	+0·15	−0·05	−0·12	−0·04	−0·01
21—24	−0·34	+0·15	−0·12	+0·03	−0·07	6— 8	+0·03	−0·18	−0·14	+0·11	−0·04
25—28	−0·14	+0·01	−0·08	+0·04	−0·04	9—12	+0·08	−0·24	+0·01	+0·01	−0·03
29— 1	−0·33	0·00	+0·04	+0·22	−0·01	13—15	+0·20	+0·02	+0·06	−0·35	−0·05
2— 5	−0·08	+0·03	+0·09	−0·36	−0·07	16—19	−0·15	+0·13	+0·02	−0·19	−0·05
6— 9	+0·01	−0·16	+0·08	−0·05	−0·02	20—22	−0·60	+0·01	+0·01	+0·01	−0·14
10—13	+0·21	−0·23	+0·01	−0·32	−0·08	23—26	+0·06	+0·12	+0·18	+0·07	+0·11

21. *Variations of Daily Mean Westerly Declination with reference to the Moon's Age and Declination.*—Table 9 has been formed from the Tables given in the former volumes of observations, and in this volume, pages 2 and 29; the means of groups of 3 or 4 days are given positive when west, and negative when east of the mean.

From Table 9 it appears,—

1*st*, That the westerly declination is greatest about two days after full moon.

2*d*, That it is greatest when the moon is farthest north.

In both cases, the epoch of maximum only is well marked; in the 3 or 4 days before it and after it, the declination is most westerly; in all the rest of the periods the variations are inconsiderable. When the smallness of the variations and the large effect of considerable disturbances are considered, the results of the separate years are sufficiently consistent, to give a considerable probability to the truth of the conclusions: in each year, the declination was more westerly *about* the time of the moon's greatest north declination, than for any other time.

TABLE 10.—Diurnal Range of Magnetic Declination with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	′	′	′	′	′	d. d.	′	′	′	′	′
14—16	9·73	16·22	14·80	13·41	13·54	27— 1	10·84	11·22	13·99	11·56	11·90
17—20	9·73	15·90	16·20	15·12	14·24	2— 5	12·60	15·48	16·83	12·16	14·27
21—24	9·25	11·59	13·64	12·94	11·85	6— 8	9·21	14·11	14·69	13·42	12·86
25—28	11·20	10·13	12·44	11·20	11·24	9—12	9·36	12·39	13·47	15·10	12·58
29— 1	9·68	11·53	13·15	12·56	11·73	13—15	10·19	12·05	12·16	14·01	12·10
2— 5	10·07	11·13	13·68	13·88	12·19	16—19	8·91	12·53	14·70	11·70	11·96
6— 9	11·92	14·08	13·89	12·96	13·21	20—22	9·75	13·16	12·10	13·82	12·21
10—13	10·42	17·44	12·31	12·49	13·17	23—26	11·00	16·08	12·00	13·16	13·06

22. *Variation of the Diurnal Range of Magnetic Declination with reference to the Moon's Age and Declination.*—The means for groups of days given in Table 10 have been deduced from the tables in the present and former volumes. It results from Table 10,—

1*st*, That the diurnal range is greatest (from the mean of 1844 and 1845, = 16′·05) about 2 or 3 days after the sun and moon are in opposition: that it is least about 3 days before they are in conjunction; the mean of 1844 and 1845 giving for that epoch 11′·28.

2*d*, That the diurnal range is greatest about 4 days after the moon is farthest north; the mean at that epoch for 1844 and 1845 being 16′·15: that it is least when the moon is farthest north, and about three days after it is farthest south; the value from the means of 1844 and 1845 in both cases being about 12′·30: that a secondary maximum of diurnal range occurs about 3 days before the moon is farthest north; the mean from 1844 and 1845 being 14′·04.

The *value* of the means of ranges is in all cases taken from the observations for 1844 and 1845, as the value for 1843 and 1846 is imperfect.

23. The means for 1843 and 1846 give the same results as the means for 1844 and 1845 for both arguments. The observations for 1844 exhibited these laws (see No. 16.) with remarkable distinctness: several single lunations shewed the law with reference to the moon's age very clearly; from these it appeared, that the variation of the diurnal range was greatest for the lunations about the equinoxes and, in connection with the first of the conclusions above, when the sun and moon were in opposition near the equator. (See volume for 1844 p. 336.) The conclusions from the 2d part of Table 10 are analogous to those already found, No. 12. for the sun's declination, and the results for both bodies may be stated thus:—The diurnal range of magnetic declination is less when the body (sun or moon) has its greatest northerly and southerly declination than at the intermediate periods; being greatest at the two epochs when the body is rather north of the equator. The variation of diurnal range in the lunar periods is as great as, or greater than, for the year, the means of 12 parts of the period in the former being compared with those for the 12 months of the latter.

24. *Variation of the Mean Difference of a Single Observation* from the Monthly Mean for the corresponding hours, *with reference to the Moon's Age and Declination.*—The results for the two years 1844 and 1845 from Table XV., 1844, p. 347, and Table XII., p. 7 of this volume, are given in Table 11.

The conclusions from Table 11 are almost identical with those from Table 10.

1*st*, The departure of the declination magnet, at any hour, from the monthly mean position, for the same hour, is greatest two or three days after opposition, and it is least about the time of conjunction.

2*d*, The departure of the declination magnet, at any hour, from its monthly mean position, for the same hour, is least when the moon is farthest north, a minimum also occurring after the greatest southerly declination; it is greatest about 4 days after the moon is farthest north, a maximum also occurring about 4 days before that epoch.

25. There are slight irregularities in the resulting means of Table 11, which are to be expected where only two years' observations are considered. The variations of these differences are rather less for the period comprehending the moon's changes of declination, than for that comprehending the sun's; the means for 2 or 3 days of the former being compared with those for the 12 months in the latter; if the mean difference for June, however, be neglected, the variations for the lunar period are quite as great as those for the solar period.

TABLE 11.—Mean Difference of a Single Observation of Magnetic Declination from the Monthly Mean, for the corresponding hour, with reference to the Moon's Age and Declination.

Moon's Age.	1844.	1845.	Mean.	Variations.	After Moon farthest North.	1844.	1845.	Mean.	Variations.
d. d.	′	′	′	′	d. d.	′	′	′	′
14—16	2·18	1·59	1·89	+0·18	27— 1	1·46	1·52	1·49	−0·21
17—20	2·04	1·87	1·96	+0·25	2— 5	1·97	2·02	2·00	+0·30
21—24	1·45	1·81	1·63	−0·08	6— 8	1·80	1·91	1·86	+0·16
25—28	1·22	1·79	1·51	−0·20	9—12	1·64	1·71	1·68	−0·02
29— 1	1·47	1·67	1·57	−0·14	13—15	1·53	1·59	1·56	−0·14
2— 5	1·35	1·63	1·49	−0·22	16—19	1·58	1·78	1·68	−0·02
6— 9	1·82	1·72	1·77	+0·06	20—22	1·69	1·42	1·56	−0·14
10—13	2·25	1·49	1·87	+0·16	23—26	2·08	1·47	1·78	+0·08

DIURNAL VARIATIONS FOR THE MAGNETIC DECLINATION.

26. *Diurnal Variation of Westerly Declination.*—The discussions for 1843 and 1844 will be found in the volumes for these years; the tables for 1845 and 1846 are contained in this volume, pages 4 and 31. Table 12 is formed from a combination of all the ordinary daily observations made in these years in the following manner. Let A and C be the means from the 4 years' observations for two hours at i hours interval, the intermediate hours having less than 4 years' observations, a and c the means from the observations for 1844 and 1845 at the corresponding hours; b_n the mean for the nth hour after a, for which there are less than 4 years' observations; then B_n the mean for the same hour referred to the means A and C has been obtained by the formula

$$B_n - b'_n = \left(\overline{a-c} - \overline{A-C}\right)\frac{n}{i}$$

where $b'_n = b_n - \overline{a - A}$.

27. Between $17^h\ 10^m$ and $9^h\ 10^m$, Makerstoun mean time, only the *even* hours have not had observations for 4 years; for these even hours, therefore, $i = 2$, $n = 1$, and the formula is reduced to

$$B - b = \frac{A - a + C - c}{2}.$$

For $22^h\ 10^m$, $0^h\ 10^m$, and $6^h\ 10^m$, b depends on 3 years' observations, 1844, 1845, and 1846, and so therefore do a and c in the formula for these hours; and in November and December the mean for $22^h\ 10^m$ is deduced from 4 years' observations (see foot-note, p. xi.) This reduction is evidently the simplest and least exacting that could be made.

TABLE 12.—Diurnal Variations of Westerly Declination for each Month, as deduced from the Regular Daily Observations made during the Four Years 1843 to 1846.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. m.	′	′	′	′	′	′	′	′	′	′	′	′
12 10	0·96	0·74	0·26	1·90	1·90	4·21	2·35	1·53	1·57	0·99	1·22	0·94
13 10	1·02	1·82	0·73	1·08	2·18	4·00	1·97	1·55	1·23	1·19	1·84	1·00
14 10	0·91	1·99	1·56	0·32	2·77	3·56	1·67	2·07	1·48	1·50	3·09	1·92
15 10	1·11	2·16	0·45	0·88	2·69	3·01	2·43	1·69	0·74	2·54	2·79	2·41
16 10	1·49	1·83	0·54	1·78	2·11	1·79	1·61	0·53	1·13	2·65	2·36	2·57
17 10	1·68	1·78	0·89	1·05	1·21	0·68	0·48	0·30	1·55	2·89	2·44	2·13
18 10	2·46	2·21	1·19	0·73	0·22	0·00	0·24	0·00	2·13	3·40	2·57	2·53
19 10	2·62	2·51	0·95	0·00	0·00	0·32	0·00	0·12	2·06	3·00	2·90	2·47
20 10	2·54	2·86	0·68	0·02	1·31	1·13	1·04	1·23	3·01	2·52	3·01	2·68
21 10	3·00	3·50	1·40	1·70	2·93	3·11	2·62	2·85	4·41	3·49	3·45	2·81
22 10	4·00	4·63	3·43	3·96	5·70	5·79	5·02	5·41	6·82	5·72	4·92	3·71
23 10	4·96	6·23	6·13	7·37	8·60	8·92	7·90	8·32	9·26	8·07	6·43	4·94
0 10	5·53	6·88	8·18	10·40	10·33	10·83	9·82	10·47	10·45	9·50	7·55	5·97
1 10	5·85	7·11	9·28	11·29	11·02	11·61	10·60	10·83	10·18	9·41	7·10	6·02
2 10	4·89	6·53	8·02	10·32	10·30	11·21	9·76	9·79	8·89	8·30	6·44	5·27
3 10	4·16	5·03	6·48	8·44	8·67	9·80	8·63	7·36	6·54	6·65	5·20	4·03
4 10	3·76	4·08	4·77	6·57	7·17	8·05	7·14	5·59	4·34	4·65	4·28	3·48
5 10	2·69	3·31	2·37	4·24	5·65	6·45	6·08	3·77	3·28	3·43	3·63	2·77
6 10	1·97	2·28	1·31	2·82	4·98	5·53	4·97	2·03	1·87	2·71	1·96	1·89
7 10	1·55	1·88	1·39	1·76	4·21	5·26	4·08	2·28	0·69	2·39	1·38	1·41
8 10	0·83	0·70	0·77	1·56	3·32	5·02	3·45	2·30	0·00	0·64	0·48	0·01
9 10	0·28	0·32	0·27	1·52	3·30	4·65	2·80	1·54	0·68	0·74	0·18	0·29
10 10	0·36	0·00	0·51	1·51	3·14	4·38	2·57	1·38	0·95	0·29	0·00	0·23
11 10	0·00	0·89	0·00	1·11	2·42	4·04	2·29	1·81	0·94	0·00	0·30	0·00

28. From Table 12 we find that the north end of the declination magnet is most westerly throughout the year between $0^h\ 20^m$ P.M., and $1^h\ 25^m$ P.M., the epochs in *apparent* time for each month being as follow:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
$0^h\ 50^m$	$0^h\ 50^m$	$0^h\ 55^m$	$1^h\ 10^m$	$1^h\ 15^m$	$1^h\ 25^m$	$1^h\ 0^m$	$0^h\ 50^m$	$0^h\ 30^m$	$0^h\ 45^m$	$0^h\ 35^m$	$0^h\ 50^m$

It appears, therefore, that the maximum westerly declination occurs farthest after *apparent* noon in the months of April, May, and June; and that it occurs soonest after apparent noon in September, October, and November.

29. The north end of the declination magnet is most easterly from April to August, from 6^h to 8^h in the morning, and from September to March from 8^h to 11^h in the evening: the approximate epochs in *apparent* time are as follow:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
$10^h\ 50^m$	$9^h\ 45^m$	$10^h\ 50^m$	$19^h\ 40^m$	$18^h\ 50^m$	$18^h\ 20^m$	$19^h\ 5^m$	$18^h\ 25^m$	$8^h\ 10^m$	$11^h\ 10^m$	$10^h\ 20^m$	$9^h\ 50^m$

30. These epochs are considerably less certain than those for the maximum, especially when they occur between $9^h\ 10^m$ and $17^h\ 10^m$, as they depend upon only two years' observations. The principal minimum occurs between 8^h and 11^h P.M. in the months from September till March, in the latter month the westerly declination at 8^h A.M. differs little from that at 11^h P.M.: in the remaining months the minimum occurs between $6^h\ 20^m$ and $7^h\ 40^m$ A.M. The morning minimum occurs earliest in June and August; the evening minimum occurs earliest in September.

31. Secondary maxima and minima of westerly declination are shewn with moderate distinctness in some months, but the epochs vary so much from one month to the next as to render it doubtful whether they are otherwise than accidental: clearer results may be expected from the combinations of the means for two or three months, if sufficient care be taken that only those months are combined which exhibit separately similar characteristics. A careful examination of the projected means, seems to shew the combinations employed for the following Table, as those best fitted for exhibiting distinctly the changing character of the diurnal variation.

TABLE 13.—Diurnal Variations of Westerly Declination for different periods deduced from Table 12.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	′	′	′	′	′	′	′	′
12 10	−1·78	−1·92	−1·73	−1·90	−2·16	−1·97	−1·85	−1·91
13 10	−1·38	−2·10	−1·69	−2·08	−2·00	−1·69	−1·96	−1·82
14 10	−1·05	−2·06	−1·62	−1·97	−1·40	−1·22	−1·88	−1·55
15 10	−0·77	−2·34	−1·93	−1·78	−1·40	−1·08	−2·02	−1·55
16 10	−0·70	−1·84	−2·83	−2·77	−1·37	−1·03	−2·48	−1·75
17 10	−0·80	−2·03	−3·84	−3·45	−1·13	−0·96	−3·11	−2·03
18 10	−0·26	−2·04	−4·67	−3·72	−0·72	−0·49	−3·48	−1·98
19 10	−0·13	−2·53	−4·62	−3·78	−0·77	−0·45	−3·64	−2·04
20 10	+0·03	−2·65	−3·56	−2·70	−0·57	−0·27	−2·97	−1·62
21 10	+0·44	−1·45	−1·76	−1·11	+0·36	+0·40	−1·44	−0·52
22 10	+1·45	+0·69	+0·96	+1·37	+2·40	+1·92	+1·01	+1·46
23 10	+2·72	+3·75	+3·98	+4·27	+4·50	+3·61	+4·00	+3·80
0 10	+3·47	+6·29	+5·80	+6·30	+5·75	+4·61	+6·13	+5·37
1 10	+3·67	+7·28	+6·53	+6·87	+5·48	+4·57	+6·89	+5·73
2 10	+2·90	+6·17	+5·97	+5·93	+4·46	+3·68	+6·02	+4·85
3 10	+1·75	+4·46	+4·45	+4·16	+2·71	+2·23	+4·36	+3·29
4 10	+1·11	+2·67	+2·83	+2·52	+1·00	+1·05	+2·67	+1·86
5 10	+0·26	+0·30	+1·27	+1·09	+0·03	+0·14	+0·89	+0·51
6 10	−0·61	−0·94	+0·47	−0·34	−1·24	−0·92	−0·27	−0·59
7 10	−1·05	−1·43	−0·05	−0·66	−1·93	−1·49	−0·71	−1·10
8 10	−2·15	−1·84	−0·61	−0·96	−3·05	−2·60	−1·14	−1·87
9 10	−2·36	−2·11	−0·81	−1·67	−2·89	−2·62	−1·53	−2·07
10 10	−2·46	−1·99	−1·02	−1·87	−3·01	−2·73	−1·63	−2·18
11 10	−2·36	−2·45	−1·55	−1·79	−3·01	−2·68	−1·93	−2·30

32. The following are the epochs of maximum and minimum westerly declination from Table 13 in apparent time:

	Dec. Jan. Feb.	Mar. April.	May. June.	July. Aug.	Sept. Oct. Nov.
Max.	0h 50m P.M.	1h 5m P.M.	1h 15m P.M.	0h 50m P.M.	0h 35m P.M.
Min.	8h P.M.—11h P.M.	8h 0m A.M.	6h 30m A.M.	6h 40m A.M.	8h P.M.—11h P.M.

33. The form of the diurnal curve is the same for each of the periods of three months; the westerly declination decreases regularly from the maximum till about 8h P.M., whereas in the curves for the summer months, the rate of decrease receives a check about 5h or 6h P.M. (see Plate I.) No secondary maximum or minimum is shewn in these means, but the magnet is nearly stationary for several hours in each case, namely from 8h to 11h P.M. in the months from September to February; from 8h P.M. till 6h A.M. in the mean for March and April, from midnight till 3h A.M. in May and June; and from 9h P.M. till 3h A.M. in June and July. The magnet is stationary for nearly twelve hours about the 23d of March: the transposition of the minimum of westerly declination from before midnight till about 8h A.M. takes place very gradually in March and April; this does not appear to be the case, however, in the return of the minimum from 7h A.M. to before midnight, which occurs about three weeks *before* the autumnal equinox.

34. When we examine the diurnal curve deduced from the observations for the whole year (Plate I.), we observe a secondary maximum of westerly declination occurring at 2h 40m A.M., nearly equal minima occurring at 11h P.M. and 6h A.M.; this secondary maximum is evidently due to the occurrence of the minimum for one-half of the year about 10h P.M., and for the other half about 7h A.M.; The mean for the year therefore does not represent, as far as these results are concerned, a real phenomenon; it is a combination of two distinct results.

35. The previous conclusions are obtained from the means of all the regular daily observations; no observation has been rejected how ever much affected by magnetic irregularity; we have still to inquire therefore to what extent irregular causes change the diurnal variation. A method has been already proposed and employed

(Makerstoun Observations for 1844, p. 339) for the determination of this question; namely, by the selection of those days in each month which appear to have been nearly unaffected by irregular disturbance; a method which it is conceived is considerably preferable to that of rejecting only those days affected with large magnetic irregularity. The variations for ten days in each month of 1844 will be found p. 339 in the volume for that year, and for seven days in each month of 1845, p. 5 of the present volume; from these two Tables the following Table has been formed :—

TABLE 14.—Diurnal Variations of Westerly Declination for different periods, deduced from Days selected as free from irregular disturbance, in the Years 1844 and 1845.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	′	′	′	′	′	′	′	′
12 10	−0·72	−1·27	−0·78	−1·13	−1·13	−0·92	−1·06	−0·99
13 10	−0·55	−1·28	−0·86	−1·35	−1·09	−0·82	−1·16	−0·99
14 10	−0·50	−1·47	−1·10	−1·40	−1·06	−0·78	−1·32	−1·05
15 10	−0·54	−1·83	−1·50	−1·78	−1·17	−0·85	−1·70	−1·28
16 10	−0·70	−1·91	−2·54	−2·58	−1·24	−0·97	−2·34	−1·66
17 10	−0·67	−2·24	−3·90	−3·97	−1·42	−1·04	−3·37	−2·21
18 10	−0·70	−2·50	−4·68	−4·70	−1·77	−1·23	−3·96	−2·60
19 10	−0·68	−3·30	−4·73	−4·73	−2·00	−1·34	−4·25	−2·80
20 10	−0·49	−3·46	−4·08	−3·79	−1·87	−1·18	−3·78	−2·48
21 10	−0·22	−2·50	−2·38	−1·69	−0·76	−0·49	−2·19	−1·34
22 10	+0·73	−0·15	+0·39	+1·16	+1·55	+1·14	+0·47	+0·80
23 10	+2·03	+2·89	+3·57	+4·08	+3·73	+2·88	+3·51	+3·20
0 10	+2·61	+5·39	+5·37	+5·90	+4·95	+3·78	+5·55	+4·67
1 10	+2·59	+6·21	+5·77	+6·38	+4·83	+3·71	+6·12	+4·92
2 10	+1·80	+5·34	+5·16	+5·41	+3·39	+2·60	+5·30	+3·95
3 10	+0·98	+3·71	+3·89	+3·60	+1·76	+1·37	+3·73	+2·55
4 10	+0·25	+1·90	+2·23	+2·04	+0·51	+0·38	+2·06	+1·22
5 10	+0·07	+0·57	+0·92	+0·88	−0·14	−0·04	+0·79	+0·37
6 10	−0·20	+0·07	+0·31	+0·13	−0·35	−0·28	+0·17	−0·05
7 10	−0·47	−0·23	+0·10	−0·03	−0·86	−0·67	−0·05	−0·36
8 10	−0·78	−0·79	−0·08	−0·25	−1·28	−1·03	−0·37	−0·70
9 10	−1·19	−1·03	−0·11	−0·29	−1·61	−1·40	−0·48	−0·94
10 10	−1·38	−0·96	−0·35	−0·66	−1·46	−1·42	−0·66	−1·04
11 10	−1·15	−1·26	−0·62	−1·10	−1·47	−1·31	−0·99	−1·15

36. The numbers in Table 14 will be found projected in dotted lines, Plate I., where the differences of the results from the whole series, and from the undisturbed series, will be at once apparent. The following are the epochs, in apparent time, of maximum and minimum westerly declination, deduced from the series of Table 14.

	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.
Maximum,	0h 35m P.M.	1h 5m P.M.	0h 55m P.M.	0h 50m P.M.	0h 30m P.M.
Minimum,	5h 40m A.M.	7h 40m A.M.	6h 45m A.M.	6h 35m A.M.	7h 30m A.M.
Secondary Maximum,	2h 5m A.M.	.....	.....	.....	2h 0m A.M.
Minimum,	10h 0m P.M.	.....	.....	.....	9h 30m P.M.

37. The principal results from the undisturbed series for the diurnal variation are as follow :—

In the quarter, September to November, the minimum of westerly declination is shewn with nearly equal distinctness at night and in the morning; a well-marked secondary maximum occurring at 2h A.M. : a similar result is exhibited in the following quarter; the morning minimum, however, being less distinctly marked than that in the evening. In both cases we find, in opposition to what has been previously conjectured, that the removal of days of disturbance causes the distinct exhibition of a morning maximum previously masked by disturbance. The means for each month from September to February shew the secondary maximum; it is seen with least distinctness in January. In the couples of months from March till August, no secondary maximum is shewn, the north end of the magnet moves eastwards from about 1h P.M. till 7h or 8h A.M., but with less velocity between 5h P.M. and 3h A.M., than before the former and after the latter hour.

38. *Diurnal Variation of the Effect of Disturbance on the Mean Declination.*—When we deduce the yearly mean declination from the days selected as free from intermittent disturbance (No. 35.) we obtain the following results :—

Mean Declination from all the hourly observations in 1844,		= 25° 17′·06,	1845, = 25° 11′·32
..... from the hourly observations in the selected	120 days of 1844,	= 25° 17′·08	
.....	60	= 25° 17′·06	
.....	84 days of		1845, = 25° 11′·39

The effect of disturbances, therefore, on the *yearly* mean position may be considered zero. When we compare the *monthly* means, as deduced from the 10 days selected in each month of 1844 and the 7 days selected in each month of 1845, with those deduced from all the hourly observations, we find that the average difference (independent of sign) for the monthly means in these two years is about 0′·2 ; a difference which may be referred with more probability to the effects of regular laws, or the fewness of the observations, than to the effect of intermittent disturbance, which is zero on the yearly mean. It is evident, therefore, that, for the purpose of the present discussion, we may assume, with little probable error, that the monthly mean from both series has the same value (as in Tables 13 and 14), and take the differences of the hourly means in the two series as measures of the effect of disturbance; any possible error in this assumption can affect the values of the differences but slightly ; the epochs of the maximum and minimum would still remain unaltered. In this manner the following Table has been formed :—

TABLE 15.—Differences of Disturbed and Undisturbed Diurnal Variations of Westerly Declination, as deduced from Tables 13 and 14, exhibiting the effect of Irregular Disturbance on the Hourly Mean Positions.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Sept. to Feb.	March to Aug.	Year.
h. m.	′	′	′	′	′	′	′	′
12 10	−1·06	−0·65	−0·95	−0·77	−1·03	−1·05	−0·79	−0·92
13 10	−0·83	−0·82	−0·83	−0·73	−0·91	−0·87	−0·80	−0·83
14 10	−0·55	−0·59	−0·52	−0·57	−0·34	−0·44	−0·56	−0·50
15 10	−0·23	−0·51	−0·43	0·00	−0·23	−0·23	−0·32	−0·27
16 10	0·00	+0·07	−0·29	−0·19	−0·13	−0·06	−0·14	−0·09
17 10	−0·13	+0·21	+0·06	+0·52	+0·29	+0·08	+0·26	+0·18
18 10	+0·44	+0·46	+0·01	+0·98	+1·05	+0·74	+0·48	+0·62
19 10	+0·55	+0·77	+0·11	+0·95	+1·23	+0·89	+0·61	+0·76
20 10	+0·52	+0·81	+0·52	+1·09	+1·30	+0·91	+0·81	+0·86
21 10	+0·66	+1·05	+0·62	+0·58	+1·12	+0·89	+0·75	+0·82
22 10	+0·72	+0·84	+0·57	+0·21	+0·85	+0·78	+0·54	+0·66
23 10	+0·69	+0·86	+0·41	+0·19	+0·77	+0·73	+0·49	+0·60
0 10	+0·86	+0·90	+0·43	+0·40	+0·80	+0·83	+0·58	+0·70
1 10	+1·08	+1·08	+0·76	+0·49	+0·65	+0·86	+0·77	+0·81
2 10	+1·10	+0·83	+0·81	+0·52	+1·07	+1·08	+0·72	+0·90
3 10	+0·77	+0·75	+0·56	+0·56	+0·95	+0·86	+0·63	+0·74
4 10	+0·86	+0·77	+0·60	+0·48	+0·49	+0·67	+0·61	+0·64
5 10	+0·19	−0·26	+0·35	+0·21	+0·17	+0·18	+0·10	+0·24
6 10	−0·41	−1·01	+0·16	−0·47	−0·89	−0·64	−0·44	−0·54
7 10	−0·58	−1·20	−0·15	−0·63	−1·07	−0·82	−0·66	−0·74
8 10	−1·37	−1·05	−0·53	−0·71	−1·77	−1·57	−0·77	−1·17
9 10	−1·17	−1·08	−0·70	−1·38	−1·28	−1·22	−1·05	−1·13
10 10	−1·08	−1·03	−0·67	−1·21	−1·55	−1·31	−0·97	−1·14
11 10	−1·21	−1·19	−0·93	−0·69	−1·54	−1·37	−0·94	−1·15

39. The conclusions from this Table are.—

1*st*, That the greatest effect of disturbance in increasing the westerly declination occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	1h 40m P.M.	9h A.M. to 1h P.M.	1h 40m P.M.	8h A.M.	8h A.M.

Throughout the year, therefore, the effect of disturbance in increasing the westerly declination is greatest between 8^h A.M. and 2^h P.M.; being near the latter hour for the months about mid-summer and mid-winter, and near the former hour for the intermediate months.

2*d*, That the greatest effect of disturbance in decreasing the westerly declination occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	8^h P.M.—12^h P.M.	6^h P.M.—11^h P.M.	11^h P.M.—12^h P.M.	9^h P.M. 10^h P.M.	8^h P.M.—11^h P.M.

3*d*, That the effect on the hourly mean westerly declination is zero

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$5\frac{1}{2}^h$ A.M. and $5\frac{1}{4}^h$ P.M.	4^h A.M. and 5^h P.M.	5^h A.M. and $6\frac{1}{2}^h$ P.M.	4^h A.M. and $5\frac{1}{2}^h$ P.M.	$4\frac{1}{2}^h$ A.M. and $5\frac{1}{2}^h$ P.M.

Diurnal Variation of frequency *of Positive and Negative Excursions from the Hourly Mean Position.*—The number of observations which were to the west of the hourly mean for each month in 1844 and 1845 having been obtained, the following Table was formed, containing the numbers per cent. for quarterly groups of months.

TABLE 16.—Numbers of Excursions of the Declination Magnet in 100 which were to the West; 1st, of the Hourly Means, as deduced from all the Hourly Observations in each Month of 1844 and 1845; and, 2d, of those deduced from the Selected Days.

Mak. Mean Time.	With reference to Mean of all.					With reference to Mean of Selected Days.				
	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.										
12 10	63·9	66·7	55·1	60·1	61·4	39·9	47·1	36·1	32·3	38·8
13 10	67·7	63·4	60·8	59·5	62·8	43·7	49·0	31·0	31·6	38·8
14 10	57·6	60·8	57·6	53·8	57·4	46·2	51·0	40·5	42·4	45·0
15 10	58·9	59·5	47·5	48·7	53·6	53·8	51·0	44·9	42·4	48·0
16 10	50·6	50·3	44·3	50·0	48·8	46·8	53·6	36·1	38·0	43·5
17 10	53·2	49·7	42·4	35·4	45·1	46·2	55·6	43·0	47·5	48·0
18 10	34·8	45·8	43·7	26·6	37·6	58·2	66·7	50·6	56·2	57·7
19 10	37·3	45·1	42·4	32·9	39·4	66·5	65·4	47·5	58·2	59·3
20 10	33·5	39·9	41·1	36·1	37·6	67·7	59·5	56·3	62·0	61·4
21 10	36·7	42·5	43·7	37·3	40·0	71·5	70·6	65·2	61·4	67·1
22 10	36·7	34·6	47·5	43·7	40·7	70·9	64·7	69·6	58·2	65·9
23 10	40·5	42·5	46·8	45·6	43·9	60·8	62·1	61·4	66·5	62·7
0 10	38·6	39·2	45·6	45·6	42·3	67·7	65·4	65·2	68·4	66·7
1 10	40·5	43·1	44·3	47·5	43·9	63·3	68·0	58·2	65·8	63·8
2 10	36·1	43·1	44·9	41·8	41·5	64·6	64·7	63·3	64·1	64·1
3 10	46·2	39·2	47·5	45·0	44·5	65·8	66·7	58·2	53·8	61·1
4 10	43·7	41·8	49·4	45·6	45·1	62·0	70·6	56·3	57·0	61·4
5 10	53·8	53·6	48·7	50·6	51·7	59·5	52·3	41·8	53·2	51·7
6 10	65·2	68·6	47·5	63·3	61·1	58·2	49·0	43·0	53·8	51·0
7 10	70·9	69·3	57·6	63·9	65·4	48·7	47·1	38·6	50·6	46·3
8 10	72·8	68·6	61·4	63·9	66·7	38·0	45·1	34·2	38·6	38·9
9 10	69·6	65·4	67·1	69·0	67·8	54·4	44·4	40·5	34·2	43·4
10 10	69·0	63·4	61·4	67·7	65·4	39·2	44·4	38·6	29·1	37·8
11 10	67·1	60·8	63·3	67·7	64·8	36·7	47·1	35·5	41·1	40·0

40. The following are the epochs of maximum and minimum frequency of the positive or westerly excursions.

	From the Means of all the Observations.		From the Means of the Undisturbed Days.	
	Min.	Max.	Min.	Max.
Nov. Dec. Jan.	8^h A.M.	8^h P.M.	11^h P.M.	$9\frac{1}{2}^h$ A.M.
Feb. March, April.	10^h A.M.	$6\frac{1}{2}^h$ P.M.	9^h P.M.	9^h A.M.—4^h P.M.
May, June, July,	$6\frac{1}{2}^h$ A.M.	9^h P.M.	8^h P.M.—1^h A.M.	10^h A.M.
Aug. Sept. Oct.	6^h A.M.	$9\frac{1}{2}^h$ P.M.	10^h P.M.—1^h A.M.	0^h Noon.

41. If we consider the mean position as deduced from *all* the observations in each month, we find that the number of observations for which the declination was to the west, is least from 6^h A.M. to 10^h A.M., and greatest from 6^h P.M. to 10^h P.M.; the reverse of course holding for the deviations to the east: if, however, we consider the hourly mean position deduced from the days selected free from disturbance, we find that the number of westerly observations is *greatest* from about 9^h A.M. till noon, and that it is least from 8^h P.M. till 1^h A.M.; which result is nearly the reverse of the other. As the maximum effect of disturbance, in increasing the westerly declination (No. 36), occurs about the same time as the maximum frequency of westerly excursions from the undisturbed position (as seen in the second result), the displacement westerly of the mean position, by disturbance, reduces the number of westerly excursions from that position to a minimum (as seen in the first result). The same explanation applies to the other epoch.

Diurnal Variation of the Sums of Disturbances of the Hourly values of Magnetic Declination in 1844 *and* 1845.—The following table contains the sums, for 100 observations, of the deviations of the north end of the declination magnet from the monthly mean positions at the corresponding hours, the latter being deduced from the days selected as free from irregular disturbance.

TABLE 17.—Hourly sums, for 100 Observations of Westerly Declination in 1844 and 1845, of the Positive and Negative Excursions from the Approximate Normal Positions for each Hour.

Mak. Mean Time.	Positive (W.) Disturbances.					Negative (E.) Disturbances.				
	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	′	′	′	′	′	′	′	′	′	′
12 10	77	138	73	101	97	272	305	259	339	294
13 10	87	144	73	107	102	277	300	253	313	286
14 10	114	159	88	157	129	198	264	215	270	237
15 10	135	146	135	177	148	178	208	159	225	193
16 10	128	190	138	141	149	147	171	172	190	170
17 10	109	167	157	225	164	123	110	134	135	126
18 10	178	189	176	286	207	69	72	116	83	85
19 10	209	203	164	294	218	43	55	118	78	74
20 10	236	218	216	344	254	38	69	80	48	59
21 10	275	258	252	335	281	40	56	77	73	62
22 10	249	230	261	260	251	51	59	66	92	67
23 10	217	206	243	260	232	66	72	98	67	76
0 10	294	241	219	250	251	55	79	88	67	73
1 10	288	250	224	250	253	72	66	99	94	83
2 10	279	257	219	268	256	64	77	81	91	78
3 10	260	243	188	244	234	112	91	109	131	111
4 10	233	213	159	197	201	122	93	108	109	108
5 10	160	149	95	157	141	150	212	113	127	150
6 10	159	108	71	123	116	294	309	125	251	244
7 10	97	108	56	97	89	274	292	168	240	243
8 10	62	95	40	70	67	382	304	194	364	311
9 10	76	120	42	52	72	303	348	170	399	305
10 10	77	101	48	62	72	345	312	158	393	302
11 10	52	94	45	87	70	374	311	220	355	315

42. The results from the Table are as follows:—

1*st*, The sum of positive or westerly disturbances

In	Nov. Dec. Jan.	Feb. March, April.	May, June, July.	Aug. Sept. Oct.
Is a maximum at	0^h Noon.	9^h A.M. and 2^h P.M.	10^h A.M.	$8\frac{1}{2}^h$ A.M.
Is a minimum at	11^h P.M.	8^h P.M.—11^h P.M.	$8\frac{1}{2}^h$ P.M.	9^h P.M.

2*d*, The sum of negative or easterly disturbances

Is a maximum at	8^h—11^h P.M.	9^h P.M.	$12\frac{1}{2}^h$ A.M.	$9\frac{1}{4}^h$ P.M.
Is a minimum at	8^h A.M.	7^h A.M.—10^h A.M.	10^h A.M.	8^h A.M.—0^h Noon.

TABLE 18.—Mean *Difference* of the Observations of Magnetic Declination in 1844 and 1845 from the Monthly Means, at the corresponding Hour in each Year, as deduced from all the Regular Observations.

Mak. Mean Time.	Mean Westerly Difference.					Mean Easterly Difference.					Mean Difference.				
	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
12 10	1·43	1·77	1·47	1·80	1·62	2·54	3·54	1·80	2·71	2·58	1·83	2·36	1·62	2·16	1·99
13 10	1·51	1·84	1·33	1·71	1·60	3·16	3·18	2·07	2·51	2·70	2·01	2·33	1·62	2·03	2·01
14 10	1·33	1·98	1·30	2·01	1·66	1·80	3·07	1·77	2·34	2·23	1·53	2·41	1·50	2·16	1·90
15 10	1·38	1·53	1·51	2·04	1·60	1·98	2·25	1·36	1·94	1·85	1·63	1·82	1·43	1·99	1·72
16 10	1·35	1·76	1·70	1·63	1·61	1·39	1·78	1·36	1·63	1·53	1·37	1·77	1·51	1·63	1·57
17 10	1·05	1·36	1·91	2·73	1·67	1·20	1·34	1·41	1·49	1·37	1·12	1·35	1·62	1·93	1·51
18 10	1·81	1·35	1·61	3·84	1·98	0·97	1·14	1·25	1·39	1·19	1·26	1·24	1·41	2·01	1·49
19 10	1·53	1·31	1·64	3·00	1·81	0·91	1·08	1·21	1·47	1·17	1·14	1·18	1·39	1·97	1·42
20 10	1·94	1·72	1·84	2·90	2·09	0·98	1·14	1·28	1·64	1·26	1·30	1·37	1·51	2·09	1·57
21 10	2·00	1·68	1·76	2·67	2·01	1·16	1·24	1·37	1·59	1·34	1·47	1·43	1·54	1·99	1·61
22 10	1·98	1·99	1·45	1·93	1·82	1·15	1·06	1·31	1·50	1·25	1·45	1·38	1·38	1·69	1·48
23 10	1·80	1·48	1·72	1·64	1·66	1·23	1·10	1·51	1·38	1·30	1·46	1·26	1·61	1·50	1·46
0 10	2·22	1·93	1·54	1·59	1·73	1·39	1·24	1·29	1·33	1·32	1·71	1·51	1·40	1·45	1·52
1 10	2·16	1·62	1·75	1·73	1·80	1·47	1·23	1·39	1·56	1·41	1·75	1·40	1·55	1·64	1·58
2 10	2·37	1·80	1·59	2·12	1·95	1·34	1·36	1·30	1·52	1·38	1·71	1·55	1·43	1·77	1·62
3 10	2·04	2·07	1·52	2·04	1·91	1·76	1·33	1·37	1·67	1·53	1·89	1·62	1·44	1·84	1·70
4 10	1·99	1·73	1·31	1·62	1·65	1·55	1·25	1·27	1·36	1·36	1·74	1·45	1·29	1·48	1·49
5 10	1·47	1·79	1·04	1·38	1·43	1·71	2·07	0·98	1·42	1·53	1·58	1·92	1·01	1·40	1·48
6 10	1·98	1·74	0·98	1·61	1·62	3·71	3·79	0·88	2·78	2·54	2·58	2·38	0·93	2·04	1·98
7 10	1·46	1·60	0·95	1·37	1·36	3·56	3·60	1·29	2·42	2·57	2·07	2·21	1·09	1·75	1·78
8 10	1·72	1·61	0·90	1·84	1·53	4·60	3·52	1·44	3·25	3·06	2·50	2·21	1·11	2·35	2·04
9 10	1·54	1·87	0·80	1·73	1·48	3·52	3·54	1·64	3·84	3·12	2·14	2·45	1·08	2·38	2·01
10 10	1·64	1·65	0·86	1·69	1·47	3·65	2·86	1·37	3·54	2·77	2·26	2·09	1·06	2·29	1·92
11 10	1·66	1·72	1·05	1·74	1·54	3·39	2·67	1·81	3·64	2·84	2·23	2·09	1·33	2·35	2·00

43. *Diurnal Variation of the Mean Excursions of the Declination Magnet, from the Monthly Mean Positions for each Hour, from the Observations for* 1844 *and* 1845.—In the previous investigations, we have considered the *effect* of irregular disturbance on the hourly mean position, the *frequency* of positive and negative excursions, and the *sums* of the latter referred to the hourly means of selected days; we have still to consider the *mean* values of the excursions which may evidently follow different laws from the sums, as the latter may depend upon both the number and mean value. Table 18 has been formed in the following manner: Half the sums of the differences of the hourly observations from the monthly means for the corresponding hours being positive and half negative, half the sums were divided by the number of positive excursions to obtain the first portion of Table 18, and by the number of negative excursions to obtain the second portion; the third portion is obtained by dividing the whole sums by the whole number of observations. Table 19 has been formed similarly, excepting that the sums of the positive and negative disturbances are unequal (See Makerstoun Observations for 1844, p. 350). The quantities in Table 18 have been termed mean differences, those in Table 19, mean disturbances; the former being related to the means for all the observations, the latter to the means of the undisturbed days. The epochs of maximum and minimum are nearly the same for both Tables; those from Table 19 only are given, as it is the best exponent of the laws with reference to approximate normal mean positions.

	Mean Westerly Disturbance.		Mean Easterly Disturbance.		Mean Disturbance.	
	Max.	Min.	Max.	Min.	Max.	Min.
Nov., Dec., Jan.,	1^h P.M.	10^h P.M.	6^h–9^h P.M.	8^h A.M.	6^h–11^h P.M.	5^h A.M.
Feb., Mar., April,	2^h P.M.	6^h–11^h P.M.	9^h P.M.	7^h–10^h A.M.	9^h P.M.–1^h A.M.	6^h A.M.
May, June, July,	8^h–11^h A.M.	9^h P.M.	$12\frac{1}{2}^h$ A.M.	8^h A.M. & 5^h P.M.	$12\frac{1}{2}^h$ A.M. & 11^h A.M.	5^h–10^h P.M.
Aug., Sept., Oct.,	$8\frac{1}{2}^h$ A.M.	9^h P.M.	10^h P.M.	8^h A.M.	10^h P.M.	5^h P.M.

44. The epochs given above can be considered only roughly approximative, since the value of the average excursion for the hours about the times noted often varies very slowly. The points of most consequence in these results are as follow:—

1*st*, The average westerly excursion from the mean position for the hour is greatest in the winter and spring quarters about 1^h or 2^h P.M.; and about 8^h A.M. in the summer and autumn quarters, although the values vary little in the summer quarter from 4^h A.M. to 1^h P.M., and in the autumn quarter a secondary maximum occurs at 3^h P.M.

2*d*, The average easterly excursion is least about 8^h A.M. in each quarter, with the exception of summer, in which it is equally small at 5^h P.M.: the average easterly excursion from the hourly mean of *all* the observations (Table 18) has the minimum decidedly marked at 6^h P.M.

3*d*, The minimum westerly excursion occurs about 9^h P.M. in all the quarters.

4*th*, The maximum easterly excursion occurs earliest in winter, about 6^h P.M., and latest in summer, namely after midnight; while in the equinoctial quarters it occurs betwixt these epochs, the values varying little from 6^h P.M. till midnight.

5*th*, The mean excursion, without reference to direction, has its greatest value earliest in winter, about 6^h P.M.; about 9^h and 10^h P.M. in the equinoctial quarters; and in summer there are two maxima of nearly equal value, immediately after midnight and at 11^h A.M., with a secondary minimum about 6^h A.M.

6*th*, The mean excursion has its least value about 5^h to 6^h A.M. in winter and spring; a secondary minimum, as noted above, occurs about the same hour in summer, and 4^h in autumn; but the actual minimum occurs, distinctly marked, between 6^h and 10^h P.M. in summer, and, less distinctly marked, about 5^h P.M. in autumn.

45. It appears from these results, that the diurnal law of mean disturbance is *not constant throughout the year*, as has been supposed; in fact *the law for summer is nearly the reverse of that for winter*, while that for autumn is nearly intermediate between the two, a secondary maximum occurring in the latter at 9^h A.M. In the winter and spring quarters there is a tendency to a secondary minimum about 4^h or 5^h P.M.

TABLE 19.—Mean *Disturbances* of Magnetic Declination, or Differences from the Monthly Means, at the corresponding Hours in 1844 and 1845, as deduced from the selected series in each Year.

Mak. Mean Time.	Mean Westerly Disturbance.					Mean Easterly Disturbance.					Mean Disturbances.				
	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
12 10	0·96	1·47	1·02	1·56	1·25	2·26	2·88	2·02	2·50	2·40	1·74	2·22	1·66	2·21	1·95
13 10	1·00	1·47	1·17	1·68	1·32	2·45	2·94	1·98	2·29	2·33	1·82	2·22	1·63	2·10	1·94
14 10	1·23	1·56	1·09	1·85	1·44	1·84	2·69	1·81	2·34	2·15	1·56	2·12	1·52	2·14	1·83
15 10	1·25	1·43	1·50	2·09	1·54	1·92	2·12	1·44	1·96	1·85	1·56	1·77	1·47	2·01	1·70
16 10	1·37	1·77	1·92	1·86	1·71	1·38	1·84	1·34	1·53	1·51	1·38	1·81	1·55	1·66	1·60
17 10	1·18	1·56	1·82	2·37	1·71	1·14	1·24	1·18	1·29	1·21	1·16	1·39	1·46	1·80	1·45
18 10	1·53	1·39	1·74	2·57	1·79	0·82	1·08	1·18	0·93	1·01	1·24	1·29	1·46	1·85	1·46
19 10	1·57	1·55	1·72	2·52	1·83	0·64	0·80	1·12	0·93	0·90	1·26	1·29	1·41	1·86	1·46
20 10	1·74	1·83	1·92	2·77	2·07	0·59	0·86	0·92	0·63	0·76	1·37	1·43	1·48	1·96	1·56
21 10	1·92	1·83	1·94	2·73	2·09	0·69	0·95	1·11	0·95	0·93	1·58	1·57	1·65	2·04	1·71
22 10	1·76	1·78	1·88	2·23	1·90	0·87	0·84	1·08	1·11	0·99	1·50	1·45	1·64	1·76	1·59
23 10	1·78	1·66	1·98	1·96	1·85	0·84	0·95	1·26	1·00	1·02	1·42	1·39	1·71	1·64	1·54
0 10	2·17	1·84	1·68	1·83	1·89	0·86	1·14	1·27	1·06	1·08	1·75	1·60	1·54	1·59	1·62
1 10	2·27	1·84	1·92	1·90	1·98	0·98	1·03	1·18	1·38	1·14	1·80	1·58	1·62	1·72	1·68
2 10	2·16	1·98	1·73	2·10	1·99	0·90	1·08	1·11	1·26	1·09	1·72	1·67	1·50	1·80	1·67
3 10	1·98	1·82	1·61	2·27	1·91	1·63	1·36	1·31	1·42	1·42	1·86	1·67	1·49	1·88	1·72
4 10	1·88	1·51	1·41	1·74	1·63	1·60	1·58	1·23	1·27	1·39	1·78	1·53	1·34	1·53	1·54
5 10	1·34	1·43	1·14	1·48	1·36	1·85	2·23	0·97	1·36	1·55	1·55	1·81	1·04	1·42	1·45
6 10	1·37	1·10	0·82	1·14	1·13	3·52	3·03	1·09	2·72	2·49	2·27	2·09	0·98	1·87	1·80
7 10	0·99	1·15	0·72	0·95	0·96	2·67	2·75	1·37	2·43	2·26	1·85	2·00	1·12	1·69	1·66
8 10	0·82	1·05	0·58	0·91	0·86	3·08	2·77	1·48	2·96	2·54	2·22	2·00	1·17	2·17	1·89
9 10	0·70	1·35	0·51	0·77	0·83	3·33	3·13	1·43	3·03	2·69	1·90	2·34	1·06	2·26	1·89
10 10	0·99	1·14	0·62	1·07	0·95	2·84	2·80	1·29	2·77	2·43	2·11	2·06	1·03	2·28	1·87
11 10	0·71	1·00	0·64	1·05	0·86	2·95	2·94	1·70	3·02	2·63	2·13	2·03	1·33	2·21	1·92

46. *Diurnal Variation of the probable error of an Observation of Magnetic Declination.*—It appears from the previous conclusions, that the best hour to make an observation of magnetic declination in winter and spring, is about 6^h A.M.; in the summer quarter, from 5^h P.M. to 10^h P.M.; and in autumn from 4^h to 5^h P.M.

The least and greatest values of the probable error of an observation from the monthly mean of the hour, for Makerstoun in 1844 and 1845, were approximately as follow :—

Winter, Least Probable Error,	5^h A.M. = 0′·8	Greatest Probable Error,	6^h P.M. = 1′·8
Spring, ...	7^h A.M. = 0′·8	.....	9^h P.M. = 1′·7
Summer, ...	6^h P.M. = 0′·6	.....	1^h A.M. & 11^h A.M. = 1′·1
Autumn, ...	5^h P.M. = 0′·9	.....	9^h P.M. = 1′·6

It is obvious, however, that even at the same place the probable error will vary with the year. In 1847, the probable error of an observation would have been greatly increased by the excessive magnetic storms of that year: neglecting these rare and excessive disturbances however, the values given above cannot be far from the truth.

Variation of Magnetic Declination with reference to the Moon's Hour-Angle.—The following Table has been constructed from Table XI. 1844, p. 342, and Table IX., p. 6, of the present volume.

TABLE 20.—Variations of Magnetic Declination with reference to the Moon's Hour-Angle for the Winter and Summer Lunations, and for all the Lunations of the Years 1844 and 1845.

Moon's Hour-Angle.	Winter Lunations.			Summer Lunations.			All the Lunations.		
	1844.	1845.	Mean.	1844.	1845.	Mean.	1844.	1845.	Mean.
h. m.	′	′	′	′	′	′	′	′	′
0 0	−0·35	−0·11	−0·23	+0·03	+0·36	+0·19	−0·21	+0·10	−0·05
2 25	−0·07	−0·02	−0·04	+0·29	+0·27	+0·28	+0·11	+0·11	+0·11
4 20	+0·30	−0·03	+0·13	+0·06	+0·34	+0·20	+0·19	+0·13	+0·16
6 15	+0·30	+0·02	+0·16	−0·04	+0·18	+0·07	+0·13	+0·09	+0·11
8 10	+0·38	+0·17	+0·27	−0·18	−0·39	−0·29	+0·10	−0·08	+0·01
10 5	+0·40	+0·27	+0·33	+0·16	−0·11	+0·03	+0·33	+0·10	+0·21
12 0	+0·49	+0·28	+0·36	+0·40	−0·28	+0·06	+0·45	+0·02	+0·23
13 55	+0·23	+0·16	+0·19	+0·02	−0·08	−0·03	+0·13	+0·05	+0·09
15 50	−0·03	−0·02	−0·03	−0·49	−0·33	−0·41	−0·25	−0·15	−0·20
17 45	−0·54	−0·26	−0·40	−0·32	−0·14	−0·23	−0·43	−0·21	−0·34
19 40	−0·69	−0·15	−0·42	+0·08	−0·16	−0·04	−0·30	−0·16	−0·23
21 35	−0·35	−0·28	−0·32	−0·04	+0·31	+0·13	−0·24	−0·01	−0·12

47. It appears from this Table, that the mean declination varies with the moon's hour-angle, as follows :—

1*st*, In winter (when the moon is in opposition north of the equator) the maximum of westerly declination, for this variation, occurs when the moon is on the meridian of 11^h, or about an hour before the inferior transit; the minimum occurs between 4^h and 5^h before the superior transit. The group for each year gives almost exactly the same result, but the range of the variation in 1844 was 1′·2, while in 1845 it was under 0′·6.

2*d*, In summer the declination needle has a double easterly and westerly motion.

The maximum westerly declination occurs about $2\frac{1}{2}$ hours after the superior transit.
The minimum westerly declination occurs about 6 hours before the superior transit.
A maximum westerly declination occurs at the inferior transit.
A minimum westerly declination occurs about 8 hours after the superior transit.

The results for the summer lunations in the two years agree to a considerable extent; the maximum at the inferior transit, however, is not nearly so distinctly marked in 1845 as in 1844. The range of the variations for the summer lunations in the two years, is for 1844 = 0′·9, for 1845 = 0′·8 nearly.

3*d*, The result from the lunations during the whole year, is a combination of the two results previously given. The principal maximum occurs at the inferior transit, and the principal minimum about 6 hours after it.

Several *single* lunations confirm the accuracy of these conclusions. See the volume for 1844, pp. 342, 343.

HORIZONTAL COMPONENT OF MAGNETIC FORCE.

48. The observations in connection with this element are of two classes:—1*st*, Observations for the absolute value of the component, made by the method of GAUSS; and, 2*d*, Observations of the bifilar magnetometer for the variations of the component. The observations for the absolute value were made with two different instruments; first, from 1843 till April 1846, with a 15-inch deflecting bar, by GAUSS's original method; and second, after April 1846, with 3·65-inch deflecting cylinders, by Dr LAMONT's modification of GAUSS's method: the whole processes have been already described in the Introductions to the different volumes of Makerstoun Observations. The following Table contains the computed values of (X) the horizontal component corresponding to the reading of the bifilar magnetometer at the time of vibration, and also the values reduced to the mean reading of the bifilar for the year of the observations; to these are affixed approximate weights, depending upon the number and agreement of the partial results, and employed in obtaining the mean in the last column:—

TABLE 21.—Results of Observations for the Absolute Value of the Horizontal Component of Magnetic Force, made in the Years 1843—1849, with the Resulting Mean Value, corresponding to the Mean Reading of the Bifilar Magnetometer for the respective Years in which the Observations were made.

	Date.	During Observation.		X Reduced to the Mean Bifilar for the Year.	Weight.	Mean Value of X for the Mean Bifilar Reading of each Year.
		Values of X.	Mean Bifilar Reading.			
15-inch Deflecting Bar.	1843.					
	August 11	3·3556	511.5	3·3512	1	
	August 21	3·3849	511·1	3·3807	3	
	November 8	3·3773	510·9	3·3732	3	3·3752
	November 14	3·3792	507·6	3·3757	2	
	December 18	3·3840	515·2	3·3813	2	
	1844.					
	February 17	3·3836	524·6	3·3851	1	
	March 23	3·3759	520·8	3·3793	2	
	May 29	3·3853	535·7	3·3816	2	3·3801
	August 5	3·3913	540·7	3·3852	2	
	December 26	3·3844	539·5	3·3789	2	
	December 30	3·3760	534·9	3·3727	2	
	1845.					
	December 29	3·3921	548·9	3·3870	2	3·3832
	December 30	3·3812	539·1	3·3807	3	
	1846.					
	February 16	3·3929	553·2	3·3910	3	3·3883
	April 14	3·3904	562·3	3·3843	2	
3·65-inch Deflecting Bar.	1847.					
	May 31	3·3918	574·8	3·3842	3	
	June 15	3·3927	576·7	3·3843	3	3·3846
	September 11	3·3791	545·0	3·3852	3	
	1849.					
	June 19	3·3963	598·0	3·3873	3	3·3917
	October 11	3·3913	568·0	3·3961	3	

49. The results for the large bar indicate an increase of absolute horizontal force from year to year between 1843 and 1846; those for the small bar exhibit a similar fact, although the considerable difference between the results for June 19 and October 11, 1849, throw some doubt on the amount of increase.

From these observations the increase of the horizontal component in *absolute measure* (see No. 53.)

From 1843 to 1845, = 0·0080 = 0·00400 yearly.
From 1844 to 1846, = 0·0082 = 0·00410 .. ... Mean of all, = 0·00388 yearly.
From 1847 to 1849, = 0·0071 = 0·00355 .....

50. The following Tables have been deduced from the observations of the bifilar magnetometer in the same manner as the Tables already given for the magnetic declination. The variations are expressed in terms of the whole horizontal component, the latter being equal to unity.

TABLE 22.—Monthly Means of the Variations of the Horizontal Component of Magnetic Force at Makerstoun.

Month.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.
January	·005055	·008747	·012663	·014943	·016211	·017925	·017805	·019392
February	·005230	·008826	·012845	·015013	·016316	·017573	·017649	·019620
March	·005627	·008584	·012661	·014988	·016354	·017806	·018064	·019638
April	·005439	·008760	·012976	·014890	·016354	·017731	·018406	·020070
May	·006492	·009769	·013679	·015340	·016716	·017751	·019054	·020833
June	·006786	·010233	·014425	·015645	·016570	·018455	·019316	·021738
July	·006714	·010104	·014584	·015572	·016939	·018146	·019305	·021358
August	·006796	·010257	·014376	·015407	·016388	·018016	·019116	·020921
September	·007054	·010542	·014360	·015078	·016233	·017857	·018552	·020647
October	·007482	·010774	·014344	·015461	·016480	·016981	·019230	·020540
November	·007692	·011579	·014740	·015851	·017161	·017584	·019029	·020975
December	·008239	·012065	·015212	·015895	·017775	·018591	·019010	·021600

51. *Monthly Mean Values of the Variations of the Horizontal Component.*—The horizontal force has increased in the greater number of cases from month to month; in March or April, and in August or September, the mean is generally less than in the immediately preceding months. The means for 1848 and 1849 are considerably less accurate than those for the preceding years, depending as they do on only two daily observations; and the means for the end of 1846 and for 1847 are much affected by excessive disturbance.

TABLE 23.—Yearly Means of the Variations of the Horizontal Component of Magnetic Force, with the Secular Change.

Year.	Horizontal Component.	Secular Increase.	
		Each Year.	Mean of 4 Years.
1842	0·006550		
1843	·010020	·003470	
1844	·013905	·003885	
1845	·015340	·001435	
1846	·016625	·001285	·002519
1847	·017868	·001243	·001962
1848	·018711	·000843	·001202
1849	·020611	·001900	·001318

52. Table 32 contains the yearly means of the quantities in Table 22, together with the resulting yearly values of the secular change. The secular change appears to have been very large in the years 1842 to 1844, and considerably smaller and more regular in the years from 1844 to 1847; the change from 1847 to 1848 is smaller, and that from 1848 to 1849 is greater, than for each of the preceding three years. It is not improbable that the change from 1842 to 1844 is increased by instrumental causes, such as stretching of the suspension wires of the magnet, while the variation of the changes in 1847–9 is evidently connected with the great disturbances of the year 1847–8. If we take the mean yearly secular change from 1845 till 1849, as probably unaffected by instrumental error, we find it = 0·001318, the horizontal component being unity; or, if we take the absolute value of the horizontal component, = 3·388, we find—

53. The mean yearly secular change of the horizontal force in absolute measure,

By the observations of the bifilar magnetometer, = + 0·00446
By the observations for the absolute force (Table 21), = + 0·00388

Such a near agreement is, perhaps, more than could have been expected: if the observations with the small deflecting bar were neglected (No. 49), the agreement would be even greater.

54. It has been shewn, No. 38, that when we deduce the yearly mean declination from the days which were selected as little affected by intermittent disturbances, the result is almost precisely the same as that deduced from the whole ordinary observations, and therefore from the days disturbed; a similar comparison being made for the horizontal component, we find as follows:—

The yearly mean of the horizontal component, as deduced from the 120 days selected as nearly free from disturbance,

In 1844, is greater than that deduced from all the hourly observations of the year by 0·000189.
In 1845, ...0·000154.

The effect of disturbance in both years was to diminish the mean value of the horizontal component on the average by 0·000172 of the whole component. It was found for 1844 (see the volume for that year, p. 365) that a more careful selection of 60 days (5 in each month) shewed even a greater effect of disturbance, namely 0·000251 for that year.

TABLE 24.—Monthly Variations of the Horizontal Component of Magnetic Force, free from Regular Secular Change.

Month.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1842 to 1845.	1846 to 1849.	1842 to 1849.	1842 to 1847.
Prefix.	0·000	0·000	0·000	0·000	0·000	0·00	0·000	0·00	0·000	0·000	0·000	0·000
January	+100	+470	+050	+114	+213	+0409	−219	−0339	+183	+016	+100	+339
February	−015	+232	−003	+091	+204	−0007	−500	−0271	+076	−143	−034	+125
March	+092	−327	−422	−027	+128	+0162	−210	−0413	−171	−084	−127	−098
April	−386	−468	−342	−218	+014	+0023	+007	−0141	−353	−024	−189	−344
May	+377	+224	+126	+139	+262	−0021	+530	+0462	+216	+308	+262	+277
June	+381	+371	+637	+351	+002	+0619	+667	+1207	+435	+624	+530	+590
July	+019	−075	+561	+185	+257	+0246	+531	+0667	+172	+425	+299	+298
August	−189	−239	+118	−073	−408	+0052	+217	+0070	−096	−017	−056	−185
September	−221	−271	−133	−495	−677	−0171	−472	−0364	−280	−421	−350	−492
October	−083	−356	−384	−205	−544	−1111	+081	−0631	−257	−551	−404	−671
November	−163	+132	−223	+092	+023	−0572	−245	−0356	−041	−287	−164	−178
December	+094	+301	+014	+043	+523	+0371	−389	+0109	+113	+153	+133	+336

55. *Annual Period of the Horizontal Component.*—Table 24 has been formed in the same manner as Table 3 (see p. xiii.) The secular changes employed in the reduction for each year, obtained in the same manner as for the magnetic declination in 1847–8 (No. 8), are as follow:—

	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.
Yearly increase,	0·003480	0·003804	0·002820	0·001116	0·001368	0·000768	0·001500	0·001920

56. The mean result for the six years 1842 to 1847, given in the last column of Table 24, is probably to be most depended on for an accurate exhibition of the mean annual law, the means for 1848 and 1849 being deduced from too few observations. The mean for the six years 1842 to 1847 shews, that *the horizontal component at Makerstoun was a maximum at the summer solstice, and also at the winter solstice; that it was a minimum shortly after the autumnal, and shortly after the vernal equinox.** This result is shewn with

* This law, as deduced from the Makerstoun Observations for 1842, was stated to the Physical Section of the British Association in June 1845, confirmed by a rediscussion of observations made at Toronto in 1842: it has since been confirmed by the observations made in the successive years at Makerstoun, and, as has been shewn in the Makerstoun Observations for 1844 (foot-note p. 357), by Dr

considerable distinctness in each of the six years; the variations from it are not greater than might be expected when we take into account the large effect of disturbances, the irregular value of the secular change in some years, and in others the fewness of the daily observations, and consequent imperfect nature of the corrections. These corrections, as deduced from the observations for 1844 and 1845, vary so much as to account fully for many of the minor differences from the mean law in the years 1842 to 1847, and for even the larger differences in the years 1848 and 1849. Upon the whole the summer maximum appears rather greater than the winter maximum, and the autumnal minimum than the spring minimum; although as this is not the case in the mean for the first four years (column 10, Table 24), and as very large disturbances occurred in the end of the years 1846 and 1847, which probably increased the autumn minimum of these years, this difference in the minima is perhaps accidental, and might be removed or considerably diminished in a larger series of observations.

57. When we compare the monthly means, as deduced from the 10 days selected in each month as least affected by irregular disturbances, with those deduced from all the hourly observations in the same months, we find the latter less (−) or greater (+) than the former, by the following quantities:—

Year.	Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1844,	0·000	−109	−346	−399	−315	−029	+018	−021	−108	−062	−507	−164	−234
1845,	0·000	−301	−160	−260	−143	−032	+021	+003	−119	−109	−251	−111	−377
Mean,	0·000	−205	−253	−329	−229	−030	+019	−009	−113	−085	−379	−137	−305

In each month, with the exception of June, the mean deduced from the undisturbed days is greater than that deduced from all the observation days; and the excess is greatest in March and October, the months of greatest disturbance: the effect of disturbance on the means for the months of May, June, and July, is very small, nearly zero.

58. As the above effects of disturbance seem to obey a law similar to that of the annual period of the mean, it will be interesting to consider the law for the latter, as deduced from the nearly undisturbed 10 days selected in each month of the years 1844 and 1845. The following are the mean variations, deduced from all the daily observations in 1844 and 1845, as in Table 24.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean of all, 0·000	+082	+044	−224	−280	+132	+494	+373	+022	−314	−294	−065	+028

Correcting these by the mean quantities in No. 57, we obtain the variations of the monthly means from the nearly undisturbed days of 1844 and 1845.

Means of 20 days, 0·000	+116	+126	−066	−222	−009	+304	+211	−036	−400	−086	−099	+162

The monthly means, deduced from 10 nearly undisturbed days in each month of the two years, give the same law as has already been deduced from the means of all the observations (as in Table 24): in the undisturbed means, the maximum at the winter solstice is rendered more marked, and it appears probable that the difference between the values of the two maxima may be wholly a result of disturbance, which appears to diminish the winter means considerably, while it rather tends to increase those at midsummer. When a more careful selection of undisturbed days is made, as in that of *five* days in each month of 1844, (see p. 365 of the volume for that year) it is found, that the effect of disturbance in diminishing the winter means, and in increasing the summer means, is even more considerable than that found above No. 57.

Differences of the Daily Means of the Horizontal Component from the Means for the corresponding Months.—The discussion for 1844, will be found in the volume for that year, page 357, the results for 1845 and 1846, are obtained from Tables XVIII. and LVII. of this volume.

Lamont's observations at Munich (1843–5), although by the combinations which he had employed he had failed in detecting the fact. The following are the variations of the Munich numbers as corrected for secular change in the note cited, the horizontal component at the place being taken as unity.

Prefix.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·000	+172	−029	−086	−029	−158	+265	+238	+280	+136	−421	−328	−045	+172

The value of this confirmation of the Makerstoun law is increased by the fact, that the Munich instrument has a unifilar suspension, and that the processes of observation, reduction, and correction, are completely different from those employed at Makerstoun.

TABLE 25.—Means of the Positive and Negative Departures of the Daily Means from the Monthly Means of the Horizontal Component of Magnetic Force, with their Differences.

Month.	Mean Positive Departures.				Mean Negative Departures.				Diff. of Mean Depart.	Mean Departures, without reference to Sign.			
	1844.	1845.	1846.	Mean.	1844.	1845.	1846.	Mean.		1844.	1845.	1846.	Mean.
Prefix.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
Jan.	0172	0316	0159	0216	0215	0538	0171	0308	−0092	0191	0398	0165	0251
Feb.	0317	0303	0284	0301	0404	0303	0171	0293	+0008	0356	0303	0213	0291
Mar.	0445	0214	0299	0319	0712	0250	0299	0420	−0101	0548	0231	0299	0359
April	0404	0285	0314	0334	0472	0641	0428	0514	−0180	0436	0394	0362	0397
May	0355	0228	0346	0310	0330	0387	0403	0373	−0063	0342	0287	0372	0334
June	0193	0177	0441	0270	0178	0225	0514	0306	−0036	0185	0198	0475	0286
July	0217	0204	0314	0245	0271	0297	0393	0320	−0075	0241	0242	0349	0277
Aug.	0353	0386	0393	0377	0380	0241	0288	0303	+0074	0366	0297	0332	0332
Sept.	0248	0315	0463	0342	0316	0315	0540	0390	−0048	0278	0315	0499	0364
Oct.	0459	0285	0345	0363	0494	0307	0586	0462	−0099	0476	0296	0434	0402
Nov.	0280	0330	0496	0369	0382	0357	0390	0376	−0007	0323	0343	0437	0368
Dec.	0258	0358	0311	0309	0413	0608	0335	0452	−0143	0318	0451	0323	0364

59. The following are the conclusions from Table 25.

1*st*, The daily mean value of the horizontal component is both most in excess and most in defect of its monthly mean value in April, and in the months from August to November; while the smallest departures from the monthly means occur about the solstices.

2*d*, The average negative departure is greater than the average positive departure, in every month of the year with two exceptions, February and August, and the excess of the former over the latter is greatest in April and December.

3*d*, As both the positive and negative departures obey nearly the same law, we in consequence find, as in the last column of Table 25, that the greatest departures of the daily means from the monthly means occur immediately after the equinoxes, and the least departures immediately after the solstices. We may generalize this result (as in the case of the magnetic declination, No. 11, 4th) thus :—The differences of the daily means of the horizontal component of magnetic force from the monthly means were a maximum when the horizontal component was least, and a minimum when it was greatest.

TABLE 26.—Mean Diurnal Range of the Horizontal Component of Magnetic Force, as deduced from the Ordinary Daily Observations.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Prefix.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1843	1396	1567	2333	4102	4119	3815	4846	4128	3268	2932	1682	1609	2983
1844	1920	2750	4980	4990	4510	3710	4290	4600	4020	3690	3140	2510	3760
1845	4095	2672	3276	5695	4512	4010	4151	4597	4441	3164	2480	3565	3888
1846	1988	2051	3520	5663	6711	5886	6807	6750	5986	3947	3597	2048	4579
1843, 1846	1692	1809	2926	4882	5415	4850	5826	5439	4627	3439	2639	1828	3781
1844, 1845	3007	2711	4128	5342	4511	3860	4220	4598	4230	3427	2810	3037	3824
Mean of all	2350	2260	3527	5112	4963	4355	5023	5019	4429	3433	2725	2433	3802

60. *Annual Variation of the Diurnal Range of the Horizontal Component of Magnetic Force.*—The means for 1844 and 1845 only, in Table 26, are comparable with each other. From the last line of Table 26 we find that the mean daily range was least in the months of December, January, and February, and less in May and June than in April, July, and August. These mean ranges are deduced from the ordinary daily observations. When we seek for the absolute ranges, as obtained from all the extra observations made in the years 1844 and 1845 (Table LX. 1844, p. 400, and Table L. p. 28 of this volume), we obtain the following numbers (prefix 0·00) :—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1844,	2943	3811	6193	6234	5088	3802	4538	5319	4538	5134	6556	2965
1845,	5758	3009	4268	6138	4733	4054	4174	5270	5062	3759	2864	3995
Mean,	4355	3410	5230	6186	4910	3928	4356	5294	4800	4446	4710	3480

These numbers follow the same law as those in Table 26, they are, however, considerably larger; the increase is most marked in the winter months. From the means of both years we may conclude that the mean value of the diurnal change of the horizontal component of magnetic force at Makerstoun in years of *moderate disturbance* is about 0·0057 in April and August, and about 0·0038 at the solstices, the whole horizontal component being unity.

TABLE 27.—Ranges of the Mean Diurnal Variation of the Horizontal Component of Magnetic Force.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0.00	0·00
1843	0928	0862	1674	3209	3409	3615	3867	3541	2698	2203	1051	0724	2128
1844	0690	0875	2195	3378	3644	3179	3657	3501	2948	2313	1305	0760	2212
1845	1742	1008	2247	3585	3623	3458	3651	3374	3282	1877	1537	1845	2387
1846	1027	0956	2333	4099	5504	4822	5550	5573	4427	2395	2392	1099	3152
Mean of all	1062	0840	2185	3482	3969	3685	4148	3997	3100	2169	1431	0897	2452

61. *Annual Variation of the Ranges of the Monthly Mean Diurnal Variation.*—From the last line of Table 27, it appears that the range of the monthly mean diurnal variation is least in December, January, and February, and that it is less in June than in May, July, or August. The following are the diurnal ranges of the monthly mean diurnal variations, as deduced from the 20 days selected as free from irregular disturbance in the years 1844 and 1845 :—

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·00	0547	0682	1833	3154	3279	3209	3417	3080	2988	2030	1291	0875

62. When we examine the mean diurnal ranges as deduced from all the observations (extra and ordinary) made in 1844 and 1845, we find that the means for March and April, and for August and September, are greater than the means for May, June, and July; when we deduce the mean diurnal range from the regular daily observations, as in Table 26, then we find only the mean for April greater than the means for May, June, and July, the means for July and August being greater than those for May and June. So when we consider the range of the monthly mean variation as in Table 27, we find the mean for June less than the means for May, July and August only; and, finally, in the ranges last given, deduced from the mean variations of undisturbed days, the differences for the months from April to September almost altogether disappear, the excess for July being in all probability accidental. This result is similar to that already found for the magnetic declination, and we may draw from it a similar conclusion, that the excess of the diurnal range in the equinoctial months over that for the midsummer months is due to irregular disturbance.

63. *Annual Variation of the Mean Difference of a Single Observation of the Horizontal Component from the Monthly Mean at the corresponding Hour.*—The mean differences for 1844 and 1845 (from Table XXXIV., 1844, p. 368, and Table XXX., p. 17, of this volume) are as follow (Prefix 0·000) :—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	350	533	823	770	568	400	469	645	587	689	591	521	579
1845,	697	515	477	650	503	421	447	577	610	473	501	699	547
Mean,	523	524	650	710	535	410	458	611	598	581	546	610	563

The conclusion deduced from the numbers for 1844, and which has been deduced from those for the magnetic declination, No. 16, is also to be obtained from the numbers for 1845, though with less distinctness, owing to the large effect of disturbance in January and December of the latter year (See No. 16.) In the mean of both years March and April shew the greatest mean difference in the first six months (and for the whole year), and August and December the greatest in the second six months: the least values are those for June and July, and for January and February.

64. From this result, June and July appear the months best fitted for observations of the horizontal component of magnetic force; the probable error of an observation from the mean for the corresponding hour in these months being under 0·0003 of the whole horizontal force.

65. *Annual Variation of the Number of Observations which were greater than the Monthly Means for the corresponding Hour.*—The numbers of observations in 100 which were greater than the monthly means for each month of the years 1844 and 1845 are as follow:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	53·1	54·8	60·1	52·1	52·5	45·7	47·1	49·8	54·3	61·2	55·6	59·6	53·8
1845,	59·6	56·8	56·9	55·0	53·2	48·3	50·8	53·0	53·0	56·2	56·3	57·3	54·7
Mean,	56·3	55·8	58·5	53·5	52·8	47·0	48·9	51·4	53·6	58·7	55·9	58·4	54·2

From these numbers it appears, that in the year there are, in 100 observations, upwards of 8 more in excess than in defect of the monthly means for the corresponding hour; that June and July were the only months which shewed more observations less than there were greater than the monthly means; that in March, October, and December, the number of observations in excess of the monthly means was greatest, being 17 in 100 more than those in defect. Upon the whole it appears probable in this, as in the other cases, that the numbers for 1844 exhibit the mean annual law with greatest truth, and that the number of positive observations is least at the summer solstice, and is greatest near the equinoxes.

MONTHLY VARIATIONS FOR THE HORIZONTAL COMPONENT.

TABLE 28.—Mean Variations of the Horizontal Component of Magnetic Force, free from Regular Secular Change, with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	0·00	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00	0·00
14—16	−0113	−0229	+0015	−0005	−0083	27— 1	+0059	+0121	+0078	−0019	+0060
17—20	−0021	−0250	−0065	−0139	−0119	2— 5	−0064	+0008	−0048	+0076	−0007
21—24	+0090	−0001	−0042	−0072	−0006	6— 8	−0070	−0127	−0154	+0037	−0078
25—28	+0142	+0203	+0085	+0088	+0129	9—12	+0026	+0012	−0034	−0060	−0014
29— 1	+0043	+0224	+0040	+0120	+0107	13—15	+0041	+0157	+0093	−0048	+0061
2— 5	+0112	+0221	−0047	+0049	+0084	16—19	−0029	+0106	−0064	+0065	+0019
6— 9	−0074	+0095	−0068	+0039	−0002	20—22	+0034	−0092	+0035	+0013	−0002
10—13	−0179	−0259	+0084	−0079	−0108	23—26	0000	−0186	+0094	−0062	−0038

66. *Variations of the Daily Mean Horizontal Component with reference to the Moon's Age and Declination.*—Table 28 has been formed from the detailed Tables in former volumes, and from the Tables pp. 11 and 32 of this volume. From the means in Table 28 we conclude:—

1*st*, That the mean horizontal component is greatest about the time of conjunction, and least about opposition, or immediately before and after that epoch. This result is shewn with great distinctness in several single lunations in 1844, (see volume for 1844, p. 358 and Plate XIV).

2*d*, That the mean horizontal component is a maximum, both when the moon is farthest north, and when it is farthest south, and that it is a minimum when the moon is near the equator. This result is shewn with considerable distinctness in the variations for both 1844 and 1845 and with some irregularity in 1843 and 1846; the less value of conclusions from the observations of the two latter years should always be borne in mind.

TABLE 29.—Diurnal Range of the Horizontal Component of Magnetic Force, with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	0·00	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00	0·00
14—16	3105	4710	3683	4906	4101	27— 1	3527	3267	3686	4209	3672
17—20	2846	4235	3959	5489	4132	2— 5	3792	4481	4429	4285	4247
21—24	2504	3127	3685	4634	3487	6— 8	3031	4115	4019	4197	3840
25—28	3282	2936	2986	4510	3428	9—12	2907	3401	3615	5377	3825
29— 1	2771	3436	3920	4434	3640	13—15	2998	3248	3491	5394	3783
2— 5	2792	3058	4492	4429	3693	16—19	2634	3546	4712	4080	3743
6— 9	3792	3874	4076	4729	4118	20—22	2795	3682	3290	5271	3759
10—13	3145	4982	3706	4370	4051	23—26	2665	4311	3137	4620	3683

Variation of the Diurnal Range of the Horizontal Component with reference to the Moon's Age and Declination.—Table 29 has been formed from the Tables in former volumes, and the Tables pages 12 and 33 of this volume.

67. The conclusions from Table 29 are :—

1*st*, That the diurnal range of the horizontal component is greatest about the time of opposition, and least about the time of conjunction; in the mean of the 4 years the range varies little from the time that the moon is 6 days till it is 20 days old; it also varies little during the remaining half lunation, but the value for the former is considerably greater than for the latter.

2*d*, In the mean of the 4 years the diurnal range is a maximum about 4 days after the moon has attained its greatest north declination; it is a minimum when the moon is farthest north. The means for 1844 and also for 1845 indicate a minimum, both when the moon was farthest north and when farthest south, with maxima during the intermediate periods; this result seems to deserve the greatest value, agreeing as it does with the conclusion deducible from a comparison of the laws of mean values and ranges, namely, that the range of the horizontal component is a maximum when its mean value is least, and *vice versa*.

TABLE 30.—Mean Difference of a Single Observation of the Horizontal Component of Magnetic Force from the Monthly Mean, at the corresponding Hour, with reference to the Moon's Age and Declination.

Moon's Age.	1844.	1845.	Mean.	Variations.	After Moon farthest North.	1844.	1845.	Mean.	Variations.
d. d.	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00
14—16	0668	0498	0583	+0018	27— 1	0533	0519	0526	−0036
17—20	0682	0591	0636	+0071	2— 5	0655	0643	0649	+0087
21—24	0441	0578	0509	−0056	6— 8	0588	0577	0582	+0020
25—28	0484	0539	0511	−0054	9—12	0510	0536	0523	−0039
29— 1	0539	0571	0555	−0010	13—15	0519	0484	0501	−0061
2— 5	0497	0568	0532	−0033	16—19	0560	0647	0603	+0041
6— 9	0605	0556	0580	+0015	20—22	0570	0472	0521	−0041
10—13	0731	0493	0612	+0047	23—26	0675	0507	0591	+0029

68. *Variation of the Mean Difference of a Single Observation from the Monthly Mean for the corresponding Hour with reference to the Moon's Age and Declination.*—The results for two years 1844 and 1845 from Table XXXV., 1844, p. 369, and Table XXIX., p. 16 of this volume, are given in Table 30. The conclusions from this Table, which are nearly the same as those from Table 29, are as follow :—

1*st*, The departure of the horizontal component from its monthly mean value for the corresponding hour, is greatest about the time of opposition, and least about the time of conjunction; the actual epochs are imme-

diately before and after those stated, a secondary minimum occurring at conjunction, and a secondary maximum at opposition; but these secondary points are probably accidental.

2*d*, The departure of the horizontal component from its monthly mean position for the corresponding hour is least when the moon is farthest south and also when farthest north; maxima occurring at the intermediate periods (see No. 16).

DIURNAL VARIATIONS FOR THE HORIZONTAL COMPONENT OF MAGNETIC FORCE.

Diurnal Variation of the Horizontal Component.—The discussions for 1843 and 1844 will be found in the volumes for these years, the Tables for 1845 and 1846 are given in this volume, pages 13 and 34. Table 31 has been formed from all the ordinary daily observations made in the 4 years, in the manner already described for the declination (Nos. 26, 27.)

TABLE 31.—Diurnal Variations of the Horizontal Component of Magnetic Force for each Month, as deduced from the Regular Daily Observations made during the Four Years 1843 to 1846.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 12	0456	0358	1576	1746	1816	2191	2346	2476	1751	1672	0843	0098
13 12	0404	0202	0995	1758	1743	1991	2158	2182	1875	1694	0884	0221
14 12	0000	0077	0893	1158	1630	1856	2012	2023	1592	1648	0855	0227
15 12	0630	0129	1285	1572	1557	1770	1918	2031	1770	1918	1039	0327
16 12	0855	0252	1271	1651	1476	1655	1745	2029	1816	1945	1162	0607
17 12	1062	0521	1329	1890	1521	1480	1574	1745	1978	1842	1227	0791
18 12	1054	0614	1575	1805	1421	1151	1435	1584	1708	1654	1330	0897
19 12	1022	0641	1275	1521	1008	0831	1080	1027	1047	1419	1125	0764
20 12	0769	0519	0709	0757	0420	0329	0560	0316	0550	0752	0740	0573
21 12	0616	0105	0308	0145	0119	0004	0094	0000	0023	0180	0183	0278
22 12	0348	0000	0000	0000	0000	0000	0000	0140	0000	0000	0000	0001
23 12	0444	0042	0208	0132	0414	0518	0502	0718	0531	0284	0104	0000
0 12	0556	0268	0632	0782	1102	1284	1249	1417	1268	0753	0566	0097
1 12	0932	0535	1324	1557	1978	1949	1915	2380	2082	1484	0835	0332
2 12	1027	0784	1756	2201	2530	2549	2764	2781	2524	1744	1028	0521
3 12	1007	0840	2071	2691	2947	2891	3444	3349	2860	2122	1131	0604
4 12	1057	0726	2185	3003	3722	3185	3753	3558	3100	2078	1027	0668
5 12	0995	0658	2132	3456	3969	3487	4049	3997	2982	2109	1431	0648
6 12	0868	0658	1958	3482	3875	3685	4148	3888	2827	2169	1428	0888
7 12	0819	0729	2049	3026	3825	3667	3847	3740	2780	2059	1139	0670
8 12	0933	0714	1966	2706	3177	3297	3459	3402	2352	2034	1111	0366
9 12	0830	0586	1769	2386	2574	2933	2957	3010	2314	1961	0866	0249
10 12	0623	0212	1575	2484	2308	2711	2654	2939	2123	1875	0878	0200
11 12	0598	0264	1808	2197	2004	2344	2543	2625	2123	1715	0776	0241

69. The following are the approximate epochs of maxima and minima in *apparent* time, as deduced from the numbers in Table 31; the principal maximum is distinguished by +, the principal minimum by −,

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Min.	22 10	−22 15	−22 15	−22 15	22 0	21 50	21 40	21 25	−21 50	−22 10	−22 40	−22 40
Max.	+ 4 0	+ 2 45	+ 4 15	+ 5 45	5 15	6 45	5 50	5 10	+ 4 20	+5	+ 6 0	+ 6 15
Min.	−14 0	−14 0	14 0	14 0	.....	.....	.....	.....	14 0	13 0	11 0	−12 0
Max.	+18 0	18 45	18 0	17 30	.....	.....	.....	.....	17 15	16 0	+18 30	+18 0

The diurnal variation of the horizontal component, at Makerstoun, consists of one maximum and one minimum in the four months May till August, and of two maxima and two minima in the eight months September till April; in each of the four months November till February, the two maxima have nearly equal values, and in each of the last three of these, the two minima are also nearly equal; from March till April.

and from October to September, the morning maximum becomes smaller in comparison with the afternoon maximum; and in May and August there are traces of the former which wholly disappear in June and July. The forenoon minimum occurs earliest in August, and before 10^h A.M. in the four months from June till September; it occurs latest in November and December, and after 10^h A.M. in the seven months October till April: the afternoon maximum occurs earliest for the first six months of the year, in February, and for the last six months, in September; it occurs latest in June and December. In order to destroy the smaller irregularities, means for groups of months have been taken; the same groups have been used as those already adopted for the magnetic declination (No. 31).

TABLE 32.—Diurnal Variations of the Horizontal Component of Magnetic Force for Different Periods, deduced from Table 31.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 12	−0232	+0062	+0026	+0212	−0006	−0119	+0100	−0010
13 12	−0260	−0223	−0110	−0029	+0056	−0102	−0121	−0112
14 12	−0435	−0574	−0234	−0182	−0063	−0249	−0330	−0290
15 12	−0174	−0171	−0314	−0225	+0148	−0013	−0237	−0125
16 12	+0035	−0138	−0412	−0312	+0213	+0124	−0287	−0082
17 12	+0255	+0010	−0477	−0540	+0254	+0254	−0336	−0040
18 12	+0319	+0091	−0691	−0690	+0136	+0227	−0430	−0101
19 12	+0273	−0201	−1058	−1146	−0231	+0021	−0802	−0390
20 12	+0084	−0866	−1603	−1761	−0747	−0332	−1410	−0871
21 12	−0203	−1373	−1916	−2152	−1299	−0751	−1814	−1283
22 12	−0420	−1599	−1977	−2129	−1428	−0924	−1902	−1413
23 12	−0374	−1429	−1511	−1589	−1122	−0748	−1510	−1129
0 12	−0229	−0892	−0784	−0866	−0566	−0398	−0847	−0623
1 12	+0064	−0159	−0014	−0052	+0039	+0051	−0075	−0012
2 12	+0241	+0379	+0562	+0573	+0337	+0289	+0505	+0397
3 12	+0281	+0782	+0942	+1197	+0610	+0445	+0974	+0709
4 12	+0281	+0995	+1476	+1456	+0640	+0460	+1309	+0884
5 12	+0231	+1195	+1751	+1824	+0746	+0488	+1590	+1039
6 12	+0269	+1121	+1803	+1819	+0713	+0491	+1581	+1036
7 12	+0203	+0938	+1769	+1594	+0565	+0384	+1434	+0909
8 12	+0135	+0737	+1260	+1231	+0404	+0269	+1076	+0673
9 12	+0019	+0478	+0776	+0784	+0286	+0152	+0679	+0416
10 12	−0191	+0430	+0532	+0597	+0197	+0003	+0520	+0261
11 12	−0168	+0403	+0197	+0385	+0110	−0029	+0328	+0149

70. The following are the approximate epochs of maxima and minima in *apparent* time from Table 32. (See also Plate II.)

	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
Minimum,	$10^h\ 20^m$ A.M.	$10^h\ 10^m$ A.M.	$10^h\ 0^m$ A.M.	$9^h\ 35^m$ A.M.	$10^h\ 0^m$ A.M.
Maximum,	$4^h\ 0^m$ P.M.	$5^h\ 15^m$ P.M.	$6^h\ 20^m$ P.M.	$5^h\ 45^m$ P.M.	$5^h\ 50^m$ P.M.
Minimum,	$2^h\ 0^m$ A.M.	$2^h\ 0^m$ A.M.	.....	.....	$2^h\ 0^m$ A.M.
Maximum,	$6^h\ 10^m$ A.M.	$5^h\ 45^m$ A.M.	.....	.....	$5^h\ 30^m$ A.M.

From these means of groups, the forenoon minimum occurs earliest in July and August, and latest in December to February; the afternoon maximum occurs earliest in December to February, and latest in May and June; the morning maximum occurs earliest in September to November, and latest in the three months thereafter; the after-midnight minimum appears to occur generally about 2^h A.M.

The previous conclusions are obtained from the means of all the daily observations; the following Table contains means for the same groups of months, deduced from the 10 days selected in each month of 1844 as free from intermittent disturbance, and the 10 days similarly selected for each month of 1845. See Table XXVIII., p. 362, 1844, and Table XXV., p. 14, of this volume.

TABLE 33.—Diurnal Variations of the Horizontal Component of Magnetic Force for Different Periods, deduced from Days selected as free from Irregular Disturbances, in the Years 1844 and 1845.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 12	−0098	+0283	+0244	+0287	+0190	+0046	+0271	+0159
13 12	−0168	+0181	+0106	+0160	+0131	−0018	+0149	+0065
14 12	−0158	+0073	−0002	+0044	+0138	−0010	+0038	+0014
15 12	−0066	+0007	−0104	+0002	+0180	+0057	−0032	+0012
16 12	+0038	+0034	−0152	−0072	+0240	+0139	−0063	+0037
17 12	+0176	+0153	−0313	−0236	+0279	+0227	−0132	+0047
18 12	+0206	+0072	−0555	−0512	+0151	+0178	−0332	−0076
19 12	+0210	−0163	−0880	−0945	−0138	+0036	−0663	−0313
20 12	+0057	−0687	−1363	−1514	−0734	−0338	−1188	−0763
21 12	−0142	−1230	−1723	−1908	−1217	−0679	−1620	−1149
22 12	−0380	−1610	−1815	−1948	−1434	−0907	−1791	−1349
23 12	−0422	−1471	−1461	−1506	−1107	−0764	−1479	−1122
0 12	−0251	−1030	−0846	−0848	−0706	−0478	−0908	−0693
1 12	+0025	−0464	−0159	−0116	−0138	−0056	−0246	−0152
2 12	+0134	+0019	+0232	+0472	+0138	+0136	+0241	+0188
3 12	+0115	+0448	+0681	+0887	+0303	+0209	+0672	+0440
4 12	+0145	+0488	+0962	+0898	+0438	+0291	+0783	+0536
5 12	+0236	+0671	+1321	+1155	+0485	+0360	+1049	+0705
6 12	+0217	+0796	+1410	+1241	+0601	+0409	+1149	+0779
7 12	+0120	+0884	+1368	+1276	+0573	+0346	+1176	+0761
8 12	+0060	+0735	+1105	+1129	+0510	+0285	+0990	+0637
9 12	−0024	+0607	+0873	+0877	+0459	+0217	+0786	+0501
10 12	−0016	+0665	+0628	+0660	+0386	+0185	+0651	+0418
11 12	−0016	+0545	+0450	+0507	+0277	+0130	+0501	+0315

71. The following are the approximate epochs in *apparent* time deduced from Table 33. (See also the dotted curves, Plate II.)

	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
Minimum,	$10^h\ 45^m$ A.M.	$10^h\ 25^m$ A.M.	$9^h\ 55^m$ A.M.	$9^h\ 50^m$ A.M.	$10^h\ 10^m$ A.M.
Maximum,	$5^h\ 30^m$ P.M.	$7^h\ 0^m$ P.M.	$6^h\ 30^m$ P.M.	$6^h\ 55^m$ P.M.	$6^h\ 35^m$ P.M.
Minimum,	$1^h\ 30^m$ A.M.	$3^h\ 20^m$ A.M.	.....	.....	$1^h\ 55^m$ A.M.
Maximum,	$6^h\ 35^m$ A.M.	$5^h\ 30^m$ A.M.	.....	.....	$5^h\ 30^m$ A.M.

A comparison of these epochs with those deduced from Table 32 will shew, that the effect of disturbance is to accelerate the epochs of the forenoon minimum and afternoon maximum, those of the latter being most affected. In the undisturbed diurnal variation the afternoon maximum occurs latest in March and April, and in July and August.

72. *Diurnal Variation of the Effect of Disturbance on the Horizontal Component.*—The following result is obtained upon the assumption, that intermittent disturbance which affects the hourly mean position does not affect the monthly mean of the 24 hours; or, that the differences found No. 57, between the monthly means of the undisturbed days, and of all the days, is due to continuous and regular laws, which have little effect on the relative hourly positions; it appears very probable from No. 58, that this assumption is not quite accurate, but that the negative quantities in the following Table are too small, and the positive ones too large; those for the summer months, however, must be near the truth, as disturbance had little or no effect on the mean for that group: the error in the values for the other periods cannot affect the *epochs* of positive and negative maxima.

TABLE 34.—Differences of Disturbed and Undisturbed Diurnal Variations of the Horizontal Component of Magnetic Force, as deduced from Tables 32 and 33, exhibiting the effect of Irregular Disturbance on the Hourly Mean Positions.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 12	−0134	−0221	−0218	−0075	−0196	−0165	−0171	−0169
13 12	−0092	−0404	−0216	−0189	−0075	−0084	−0270	−0177
14 12	−0277	−0647	−0232	−0226	−0201	−0239	−0368	−0304
15 12	−0108	−0178	−0210	−0227	−0032	−0070	−0205	−0137
16 12	−0003	−0172	−0260	−0240	−0027	−0015	−0224	−0119
17 12	+0079	−0143	−0164	−0304	−0025	+0027	−0204	−0087
18 12	+0113	+0019	−0136	−0178	−0015	+0049	−0098	−0025
19 12	+0063	−0038	−0178	−0201	−0093	−0015	−0139	−0077
20 12	+0027	−0179	−0240	−0247	−0013	+0006	−0222	−0108
21 12	−0061	−0143	−0193	−0244	−0082	−0072	−0194	−0134
22 12	−0040	+0011	−0162	−0181	+0006	−0017	−0111	−0064
23 12	+0048	+0042	−0050	−0083	−0015	+0016	−0031	−0007
0 12	+0022	+0138	+0062	−0018	+0140	+0080	+0061	+0070
1 12	+0039	+0305	+0145	+0064	+0177	+0107	+0171	+0140
2 12	+0107	+0360	+0330	+0101	+0199	+0153	+0264	+0209
3 12	+0166	+0334	+0261	+0310	+0307	+0236	+0302	+0269
4 12	+0136	+0507	+0514	+0558	+0202	+0169	+0526	+0348
5 12	−0005	+0524	+0430	+0669	+0261	+0128	+0541	+0334
6 12	+0052	+0325	+0393	+0578	+0112	+0082	+0432	+0257
7 12	+0083	+0054	+0401	+0318	−0008	+0038	+0258	+0148
8 12	+0075	+0002	+0155	+0102	−0106	−0016	+0086	+0036
9 12	+0043	−0129	−0097	−0093	−0173	−0065	−0107	−0085
10 12	−0175	−0235	−0096	−0063	−0189	−0182	−0131	−0157
11 12	−0152	−0142	−0253	−0122	−0167	−0159	−0173	−0166

73. The conclusions from Table 34 are,—

1*st*, That the greatest effect of disturbance in increasing the horizontal component occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$3^h\ 20^m$ P.M. and 6^h A.M.	$4^h\ 40^m$ P.M.	$5^h\ 0^m$ P.M.	$5^h\ 15^m$ P.M.	$3^h\ 40^m$ P.M.

In the months December to February there are two maxima of the positive effect of disturbance, the second maximum occurring about 6^h A.M.; this is also shewn, though less distinctly, in the quantities for March and April. The greatest positive effect of disturbance occurs latest in July and August, and earliest in the months from September to February; occurring throughout the year betwixt 3^h P.M. and 5^h P.M.

2*d*, That the greatest effect of disturbance in diminishing the horizontal component occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	1^h A.M.	2^h A.M.	$2^h\ 30^m$ A.M.	$5^h\ 40^m$ A.M.	11^h P.M.

A secondary negative maximum occurs in December to February, about $9^h\ 30^m$ A.M., and in March and April about $8^h\ 30^m$ A.M. The greatest negative effect of disturbance on the hourly mean position, occurs earliest in the months September to November, namely about 11^h P.M., it occurs farther and farther after that hour in the months following, till July and August, when it occurs about $5^h\ 40^m$ A.M.

3*d*, From what has been said, No. 72, the hours when the effect of disturbance is zero must be less certain, they are from Table 34.

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	4^h A.M. 10^h A.M. 8^h P.M.	10^h A.M. 8^h P.M.	$11\frac{1}{2}^h$ A.M. $8\frac{1}{2}^h$ P.M.	$0\frac{1}{2}^h$ P.M. $8\frac{1}{2}^h$ P.M.	11^h A.M. 7^h P.M.

The hours for the months December to February are very uncertain, owing to the irregularity and smallness of the variations. Throughout the year the effect of disturbance is zero *about* 11^h A.M. and *about* 8^h P.M.

Diurnal Variation of frequency of the Positive Departures from the Hourly Mean Positions.—The number of observations having been obtained for each month in 1844 and 1845, which shewed a greater value of the horizontal component than the monthly means at the corresponding hours, the means of quarterly groups were formed, and the numbers per cent. are given in the following Table.

TABLE 35.—Numbers of Observations of the Horizontal Component of Magnetic Force in 100, which were greater than the Monthly Mean at the corresponding Hour in the Years 1844 and 1845, for each Quarter, and for the Year.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.						h. m.					
12 12	63·3	59·7	49·4	59·5	58·0	0 12	52·5	51·9	50·6	51·9	51·7
13 12	62·0	64·3	50·6	55·7	58·1	1 12	52·5	48·7	51·3	47·5	50·0
14 12	65·8	68·8	50·0	58·9	60·9	2 12	55·7	46·1	46·2	53·2	50·3
15 12	60·8	60·4	50·6	56·3	57·0	3 12	55·7	39·0	47·5	45·0	46·8
16 12	55·7	58·5	56·3	53·2	55·9	4 12	63·3	45·5	46·2	41·8	49·2
17 12	57·0	57·1	54·4	62·7	57·8	5 12	57·6	49·4	51·9	44·9	50·9
18 12	50·6	53·2	51·3	57·0	53·0	6 12	48·1	51·9	44·9	51·3	49·0
19 12	51·9	57·1	48·7	56·3	53·5	7 12	59·5	50·6	46·8	53·2	52·5
20 12	51·9	59·1	48·7	57·6	54·3	8 12	55·7	56·5	42·4	55·7	52·6
21 12	55·7	61·7	51·3	55·1	55·9	9 12	58·2	57·8	45·6	57·0	54·6
22 12	56·3	59·7	51·3	61·4	57·2	10 12	65·2	60·4	48·7	58·9	58·3
23 12	54·4	57·1	48·1	57·6	54·3	11 12	59·5	59·1	52·5	60·1	57·8

74. The following are the approximate epochs of maximum and minimum frequency of positive departures, as deduced from Table 35.

	Nov. Dec. Jan.	Feb. March, April.	May, June, July.	Aug. Sept. Oct.	Year.
Maximum,	1^h A.M.	2^h A.M.	4^h A.M.	11^h P.M. to 11^h A.M.	2^h A.M.
Minimum,	7^h A.M. and 1^h P.M.	3^h P.M.	8^h P.M.	4^h P.M.	3^h P.M.

The numbers in Table 35 present considerable irregularities; two years' observations appear too few to remove these. In the winter and spring quarters, there is a secondary maximum of frequency of positive departures about 9^h A.M., a secondary minimum occurring in the winter quarter about noon, and in the spring quarter about 6^h A.M. The variation of the numbers is greatest in the spring and autumn quarters, it is least in summer. Every hour in winter, with one exception, had more observations greater than the monthly mean for the hour, than there were less; in spring and autumn, all the hours had a greater number of positive than of negative departures, excepting those from 1^h to 5^h P.M. The minimum of positive frequency occurs about 7^h A.M. in winter, but in summer it occurs nearer 7^h P.M. The hours of maximum frequency of the positive departures, are obviously those of minimum frequency of negative departures.

75. It may be remarked here, that these departures are from the mean position of all the ordinary observations, which mean position is more or less affected by disturbance; could the undisturbed mean position be well ascertained it would probably be found, as it has been in the case of the declination, No. 41, that the hour of maximum frequency of the positive departures from the disturbed mean position, is nearly that of their minimum frequency from the undisturbed mean position; this, it will be seen, was the case when the selected days were assumed as the normal means, as in 1844. (See volume for 1844, page 372).

76. *Diurnal Variation of the Mean Differences of the Values of the Horizontal Component from the Monthly Mean Values for the corresponding Hours.*—Table 36 has been formed in the manner already indicated, No. 43, for Table 18. The numbers in Table 36 exhibit such considerable irregularities, that it is difficult in some cases to determine real secondary points of maximum and minimum from those which may be merely accidental, and which might have disappeared in the combination of a larger series of observations; the following however, are the approximate epochs as nearly as they can be determined.

TABLE 36.—Mean Difference of the Observations of the Horizontal Component of Magnetic Force, in 1844 and 1845, from the Monthly Means, at the corresponding Hour in each Year, as deduced from all the Regular Observations.

Mak. Mean Time.	Mean Positive Difference.					Mean Negative Difference.					Mean Difference.				
	Nov. Dec. Jan.	Feb. Mar. April.	May. June, July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June, July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June, July.	Aug. Sept. Oct.	Year.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 12	0496	0650	0425	0538	0531	0863	0956	0417	0790	0733	0630	0774	0421	0640	0616
13 12	0431	0702	0413	0512	0522	0704	1276	0421	0638	0721	0535	0906	0417	0568	0606
14 12	0568	0807	0385	0505	0589	1103	1840	0385	0727	0921	0750	1141	0385	0596	0718
15 12	0395	0567	0463	0415	0461	0618	0868	0675	0539	0612	0482	0686	0468	0469	0526
16 12	0392	0536	0410	0436	0444	0489	0755	0532	0491	0565	0435	0627	0463	0462	0497
17 12	0405	0583	0369	0487	0461	0537	0875	0442	0812	0637	0462	0665	0402	0609	0535
18 12	0416	0403	0414	0534	0443	0424	0454	0439	0708	0500	0420	0427	0426	0609	0470
19 12	0404	0451	0472	0527	0464	0437	0598	0445	0684	0534	0420	0514	0458	0595	0497
20 12	0425	0475	0506	0606	0502	0460	0684	0477	0820	0601	0442	0561	0491	0697	0547
21 12	0482	0529	0429	0573	0504	0601	0845	0456	0700	0641	0535	0651	0442	0630	0564
22 12	0484	0503	0510	0546	0513	0629	0740	0541	0873	0680	0547	0599	0525	0672	0585
23 12	0495	0506	0555	0554	0524	0593	0671	0512	0749	0627	0540	0577	0533	0637	0571
0 12	0513	0529	0544	0588	0547	0567	0573	0555	0637	0580	0539	0550	0549	0612	0563
1 12	0459	0492	0529	0608	0521	0507	0463	0562	0550	0521	0482	0477	0545	0578	0521
2 12	0422	0528	0592	0607	0530	0526	0450	0505	0684	0540	0468	0486	0545	0643	0535
3 12	0401	0692	0620	0723	0591	0500	0443	0561	0591	0525	0445	0540	0589	0651	0556
4 12	0435	0632	0592	0837	0606	0756	0528	0462	0606	0582	0552	0575	0545	0703	0594
5 12	0488	0611	0472	0591	0536	0660	0599	0511	0484	0558	0561	0605	0491	0532	0547
6 12	0794	0552	0512	0456	0592	0733	0598	0512	0485	0569	0762	0574	0512	0470	0580
7 12	0600	0482	0480	0539	0530	0881	0492	0425	0607	0585	0714	0487	0451	0571	0556
8 12	0568	0527	0433	0540	0521	0708	0684	0320	0673	0576	0630	0595	0368	0599	0547
9 12	0607	0615	0426	0533	0553	0838	0849	0356	0707	0663	0704	0713	0388	0608	0603
10 12	0541	0591	0411	0465	0505	1004	0905	0387	0670	0712	0703	0715	0399	0549	0591
11 12	0559	0558	0400	0514	0508	0821	0914	0442	0771	0701	0665	0658	0420	0617	0589

1*st*, The average *positive* difference of an observation of the horizontal component has its maximum and minimum values at the following hours in the means of the four quarters, the times of the principle values being distinguished by + and −

	Nov. Dec. Jan.	Feb. March, April.	May, June, July.	Aug. Sept. Oct.	Year.
Minimum,	− 6^h A.M.	-7^h A.M.	-2^h A.M.	-3^h A.M	-5^h A.M.
Maximum,	$11\frac{1}{2}^h$ A.M.	$3\frac{1}{2}^h$ P.M.	$+3^h$ P.M.	$+4^h$ P.M.	$+4\frac{1}{2}^h$ P.M.
Minimum,	− 3^h P.M.	7^h P.M.	.....	.....	.....
Maximum,	+ $6\frac{1}{2}^h$ P.M.	$+2^h$ A.M.	.....	.....	.....

A maximum occurs in each quarter between 3^h P.M. and 6^h P.M., and *the* minimum occurs in each quarter between 2^h A.M. and 6^h A.M.; there are, however, several points of opposition: thus, the principal minimum in summer and autumn occurs at the hour of the principal maximum in spring; and one of the two equally-marked minima of winter occurs at the same hour as the principal maximum in summer and autumn, and as the well-marked secondary maximum in spring.

2*d*, The average *negative* difference has the following epochs of maxima and minima.

	Nov. Dec. Jan.	Feb. March, April.	May, June, July.	Aug. Sept. Oct.	Year.
Maximum,	$+11\frac{1}{2}^h$ P.M.	$+2^h$ A.M.	$+3^h$ A.M.	$+11\frac{1}{2}^h$ P.M.	$+2^h$ A.M.
Minimum,	$-6\frac{1}{2}^h$ A.M.	6^h A.M.	7^h A.M.	$-3\frac{1}{2}^h$ A.M.	-6^h A.M.
Maximum,	10^h A.M.	9^h A.M.	$+1^h$ P.M.	$+10^h$ A.M.	10^h A.M.
Minimum,	2^h P.M.	-2^h P.M.	$-8\frac{1}{2}^h$ P.M.	$-5\frac{1}{2}^h$ P.M.	-2^h P.M.

A principal maximum occurs in each quarter betwixt 11^h P.M. and 3^h A.M.; a secondary or principal maximum occurs betwixt 9^h A.M. and 1^h P.M. The least values of the negative mean difference occurs about the same hours in summer as the greatest values occur in winter, namely, between 8^h P.M. and midnight.

3*d*, The mean difference, independent of sign, has the following epochs of maximum and minimum.

	Nov. Dec. Jan.	Feb. March, April.	May, June, July.	Aug. Sept. Oct.
Maximum,	$+8^h$ P.M.	$+2^h$ A.M.	$+2^h$ P.M.	11^h P.M.
Minimum,	$-6\frac{1}{2}^h$ A.M.	-6^h A.M. to 6^h P.M.	-9^h P.M.	$3\frac{1}{2}^h$ A.M.
Maximum,	10^h A.M.	.....	.....	10^h A.M.
Minimum,	3^h P.M.	.....	.....	6^h P.M.

77. The opposition in the epochs of maximum and minimum is even more considerable for the mean difference than for its positive and negative elements. We find, as has already been found for the magnetic declination, No. 45, that the diurnal law of disturbance of the horizontal component varies with season, and that the law for summer is nearly the reverse of that for winter. In summer, the minimum disturbance occurs about 8^h P.M., which is the hour of the maximum disturbance in winter; in summer, the maximum disturbance occurs about 3^h P.M., which is the hour of a minimum in winter, which differs little in value from the principal minimum; the law for autumn also differs considerably from that for spring, the least values of the disturbance occur in the latter between 6^h A.M and 6^h P.M., while the greatest values occur in the former between 8^h A.M. and 4^h P.M.

78. *Probable Error of Observations of the Horizontal Component.*—At Makerstoun, in years of moderate disturbance, the probable error of an observation of the horizontal component from the monthly mean for the hour of observation has its least values as follow :—

Winter, between 4^h A.M. and 4^h P.M., the probable error being less than 0·0004 of the whole component.
Spring, ... 6^h A.M. ... 6^h P.M. ..... 0·0005 .....
Summer, ... 8^h P.M. ... 8^h A.M. ..... 0·0003 .....
Autumn, 3^h and 4^h A.M. and 6^h P.M. ..... 0·0004 .....

Variation of the Horizontal Component with reference to the Moon's Hour-Angle.—The following Table has been formed from Table XXXI., 1844, p. 391, and Table XXVI., p. 15, of the present volume.

TABLE 37.—Variations of the Horizontal Component of Magnetic Force with reference to the Moon's Hour-Angle for the Winter and Summer Lunations, and for all the Lunations of the Years 1844 and 1845.

Moon's Hour Angle.	Winter Lunations.			Summer Lunations.			All the Lunations.		
	1844.	1845.	Mean.	1844.	1845.	Mean.	1844.	1845.	Mean.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
0 0	−0066	−0018	−0042	+0029	+0050	+0039	−0019	+0014	−0002
2 25	−0132	+0131	0000	+0021	+0163	+0091	−0056	+0147	+0045
4 20	−0059	−0107	−0083	+0018	+0081	+0049	−0021	−0019	−0020
6 15	−0046	−0046	−0046	−0028	−0004	−0016	−0037	−0026	−0031
8 10	+0004	−0112	−0054	−0060	−0182	−0121	−0028	−0143	−0085
10 5	−0036	−0021	−0028	−0012	+0029	+0008	−0023	+0003	−0010
12 0	+0122	+0029	+0075	+0086	+0102	+0093	+0104	+0063	+0083
13 55	+0099	+0074	+0086	+0157	+0092	+0124	+0128	+0083	+0105
15 50	−0001	+0123	+0061	+0030	−0039	−0005	+0014	+0049	+0031
17 45	+0093	+0047	+0070	−0053	−0102	−0078	+0014	−0021	−0003
19 40	+0065	−0025	+0020	−0126	−0130	−0128	−0031	−0073	−0052
21 35	−0028	−0081	−0054	−0056	−0055	−0056	−0044	−0068	−0056

79. The following are the conclusions from Table 37.

There are four independent results in this Table, two for the winter lunations of 1844 and 1845, and two for the summer lunations of the same years; the other columns are derived from these: of the four results three give the same law so nearly, that the result for the two years may be derived from either with but little error in epochs; that result from the last column of the Table is as follows :—

A maximum of the horizontal component about $1\frac{1}{4}$ hours after the inferior transit.
A minimum ..... 3 hours before the superior transit.
A maximum ..... 2 hours after the superior transit.
A minimum ..... 8 hours after the superior transit.

80. The result for the winter lunations of 1844 agrees with this, in shewing a maximum immediately after the inferior transit; but differs from it in having the minimum about the hour of the second maximum for the other periods; this difference, it is conceived, is chiefly the effect of disturbances, as has been found when the larger disturbances were eliminated. (See the volume for 1844, p. 365.)

VERTICAL COMPONENT OF MAGNETIC FORCE.

81. Observations for the absolute value of the vertical component were made in 1846 in the manner described in the Introduction to the Observations for 1844, p. liii. (foot-note), but they have not been reduced; indeed, it is doubtful whether the dimensions of the magnets employed, and the errors of the instrument were likely to admit a sufficiently accurate result. We may deduce the absolute value of the vertical component from the observations for the horizontal component and magnetic dip; assuming the latter $=71^\circ\ 15'$ for the year 1845, we find the mean value of the former from the observations with the large deflecting bar (last column of Table 21) for the year 1845 $=3{\cdot}3837$;—whence the absolute value of the vertical component of magnetic force for 1845 $=9{\cdot}9680$. The following results are deduced wholly from the observations of the balance magnetometer: the variations are given in parts of the whole vertical component assumed equal to unity.

TABLE 38.—Monthly Means of the Variations of the Vertical Component of Magnetic Force at Makerstoun.

Month.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.
January	·012155	·009905	·007838	·005904	·003917	·002523	[·001880]	·001157
February	·011988	·009708	·007458	·005616	·003737	·002636	·001800	·001004
March	·011495	·009325	·007341	·005475	·003663	·002659	·001684	·000747
April	·011446	·008992	·007384	·005361	·003526	·002668	·001379	·000537
May	·011323	·008804	·007062	·005192	·003603	·002599	·001085	·000472
June	·011167	·008878	·006847	·005034	·003936	·002488	·000936	·000467
July	·010883	·008732	·006552	·004740	·003839	·002415	·001561	·000314
August	·010797	·008562	·006341	·004643	·003678	·002184	·001197	·000079
September	·010672	·008158	·006267	·004534	·003584	·002141	·000705	·000129
October	·010471	·008138	·006129	·004310	·003206	·002299	·001354	·000127
November	·010355	·008109	·006155	·004307	·002899	·002344	·001361	·000109
December	·010129	·007992	·006003	·004315	·002643	·002168	·001346	·000017

82. Table 38 contains the monthly means of the balance magnetometer readings, as deduced from the regular daily observations; these in 1848 and 1849 were only two daily. From 1842 to 1847 the balance needle occupied a position *at right angles to* the magnetic meridian; in 1848 and 1849 its position was *in* the magnetic meridian. The monthly means diminish with a few exceptions from month to month throughout the whole period. The yearly means of the variations and secular changes are given in Table 39.

TABLE 39.—Yearly Means of the Variations of the Vertical Component of Magnetic Force, with the Secular Change.

Year.	Mean of Variations of Vertical Component.	Secular Change.		
		Year to Year.	Mean of Each Four Years.	During Each Year.
1842	0·011073			0·002327
1843	·008774	0·002299		2108
1844	·006781	1993		1966
1845	·004953	1828		1733
1846	·003519	1434	0·001888	1151
1847	·002427	1092	1587	1077
1848	·001357	1070	1356	0867
1849	·000430	0927	1131	1125

83. The numbers in the last column of Table 39 have been obtained by comparing the mean of the first six months of the year, for which the secular change is sought, with that for the corresponding six months of the following year, and the mean for the last six months with the corresponding months of the preceding year ; the mean of the two is taken for the secular change during the year : only one comparison could be made for 1842 and for 1849.

84. The vertical component has diminished from year to year ; the value of the secular change has also diminished since 1842 ; the greatest diminution occurring in the year 1846, after which year the value of the secular change has not varied greatly : it was least in 1848, and appears as large in 1849 as in 1846. It is probable that the apparent secular change is partially, if not wholly, due to loss of magnetism in the needle, especially in the first four years. (See the Section *Magnetic Dip.*)

85. When we deduce the yearly value of the vertical component of magnetic force from the days selected as nearly free from irregular disturbance in 1844 and 1845 (see volume for 1844, p. 384, and Table XXXVII., p. 21, of this volume), and compare these values with those obtained from all the ordinary observations in each year, we find, that the yearly mean of the vertical component deduced from the nearly undisturbed days

In 1844 is greater than that deduced from all the hourly observations of the year, by 0·000021
In 1845 ..... 0·000039

The effect of disturbance in both years was to diminish the mean value of the vertical component on the average by 0·000030. See Nos. 38 and 54.

86. *Annual Period of the Vertical Component.*—In the discussion of the observations for 1844 it was found that the result for the annual period differed considerably from that obtained for the previous year ; separate discussions of the observations for the different years shewed so many differences, that it was concluded that the instrument was incapable of exhibiting the law, if any such existed ; this conclusion was quite in accordance with that previously made by those who had examined the instrument with the greatest care. A combination of the results for several years, however, has rendered it probable that the errors of the instrument or irregularities in the law have been eliminated to a considerable extent, and that the true law has been obtained ; this will appear from the following discussion.

TABLE 40.—Monthly Variations of the Vertical Component of Magnetic Force, free from Regular Secular Change.

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Prefix.	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000
1843–6	+086	−030	−064	−054	−060	+094	+031	+016	−009	−054	+013	+028
1842–7–8–9	−014	+027	−071	−097	−121	−113	+028	−088	−127	+137	+229	+215
1842–9	+036	−001	−068	−075	−090	−010	+030	−036	−068	+041	+121	+122
1842–7	−007	−046	−099	−052	−040	+065	+011	−005	−002	+008	+088	+079

Table 40 has been formed in the following manner : The monthly means for the different groups of years having been obtained from Table 38, the means for each group were corrected for secular change in the manner described No. 8, the secular change employed being the mean for the respective years in the last column of Table 39 ; the numbers in Table 40 are the variations about the yearly mean for each corrected group.

87. The four years 1843–6 are those best fitted for exhibiting the annual law, the diurnal series of observations being sufficiently large to give the monthly mean without any considerable error. The result from this group is as follows : The vertical component is a maximum in June and January, and it is a minimum in April and October. The remaining four years, especially the years 1848 and 1849, though but indifferently fitted to exhibit a law liable to so many irregularities, (owing to the fewness of the observations made daily, and to the great magnetic disturbances in the last two years,) yet they exhibit a rough approximation to the same result : for this group, the vertical component is a maximum in November and December, a secondary maximum occurring in July ; and it is a minimum in May and September. The group of six years, 1842–7, includes all the years during which a sufficient number of daily observations were made to give moderate approximations to the monthly means, and this group indicates a law similar to that from the four years 1843–6. Neglecting at present the considerations in favour of the law obtained from the four best years, the chief source of doubt as to the value of the result, is to be found in the irregularity and great variation of the secular change to be eliminated. In order to examine the monthly means free from this objection the following Table has been formed.

TABLE 41.—Mean Change of the Value of the Vertical Component from Month to Month for different Groups of Years, as deduced from Table 38.

Years.	Dec. to Jan.	Jan. to Feb.	Feb. to March.	March to April.	April to May.	May to June.	June to July.	July to Aug.	Aug. to Sept.	Sept. to Oct.	Oct. to Nov.	Nov. to Dec.	Mean.
Prefix.	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000
1843–6	−219	−261	−178	−135	−150	+008	−208	−160	−170	−190	−078	−129	−156
1842–9	−205	−166	−194	−137	−144	−048	−090	−194	−161	−019	−049	−128	−128
1842–7	−194	−183	−197	−097	−132	−039	−196	−159	−141	−134	−064	−153	−141

88. Considering the numbers for the years 1843–6, we find that the mean change of the vertical component from one month to the next = 0·000156, that the diminution in the months from December to March and from June to October was *greater* than the mean, while those from March to June and from October to December were *less*; the other groups give nearly the same result, which is quite in accordance with that from Table 40. From both Tables we feel entitled to state the following as the annual law,—*That the vertical component of magnetic force is a maximum near the solstices and a minimum near the equinoxes.* It will be observed *that this is precisely the law* already deduced for the horizontal component No. 56; had it not been for this remarkable coincidence in a law with two maxima and two minima, obtained from two instruments of the most different principles, the conclusions deduced from the observations of the balance magnet would have been left with whatever weight they might appear to physicists to deserve; but it is conceived that the agreement is too considerable and too remarkable to omit adducing it as evidence in estimating the accuracy of this result for the vertical component.

89. If we compare the monthly means deduced from the days selected in each month as nearly free from intermittent disturbance, with those deduced from all the hourly observations in the corresponding months, we find the latter less (−) or greater (+) by the following quantities.

Year. Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1844, 0·000	−039	+096	−124	+003	−071	−031	−031	−020	−048	−043	+006	+051
1845, 0·000	−068	−036	−039	−086	−061	+018	−049	−091	−049	−046	+008	+024
Mean, 0·000	−053	+030	−081	−041	−066	−006	−040	−055	−048	−044	+007	+037

The numbers differ considerably in some cases for the same month in the two years; a greater number of partial results are therefore evidently required for a good mean. The mean of both years shews, that the disturbed means were greater than the undisturbed in November, December, and February (or, about the winter solstice), and less in all the other months, the diminution being greatest in March, May, and August.

Differences of the Daily Means of the Vertical Component from the Means for the corresponding Months.—The discussion for 1844 will be found in the volume for that year, p. 374, the results for 1845 and 1846 are obtained from Tables XXXI. and LXIII., pages 18 and 35 of this volume.

90. The conclusions from Table 42 are :—

1*st*, That the positive departures of the daily mean vertical component from the monthly mean value are greatest in September and in February, and that they are least in January and June.

2*d*, That the negative departures of the daily mean from the monthly mean are greatest in September, January, and May, and least in March and July.

3*d*, That the mean positive departure is most in excess of the mean negative departure in February, while the latter is most in excess of the former in January, and in the months from March to June; with the exception of February, the mean negative departure is greater than the mean positive departure in the first six months of the year; and, with the exception of August, the reverse is the case for the last six months.

4*th*, That the mean departure of the daily mean from the monthly mean (without reference to sign) is greatest in September, and least in March.

5*th*, The mean departure of the daily mean vertical component from the monthly mean for 1844 = 0·000105
..... 1845 = 0·000117
..... 1846 = 0·000131
..... 3 years = 0·000118

TABLE 42.—Means of the Positive and Negative Departures of the Daily Means from the Monthly Means of the Vertical Component of Magnetic Force, with their Differences.

Month.	Mean Positive Departures.				Mean Negative Departures.				Diff. of Mean Depart.	Mean Departures, without reference to Sign.			
	1844.	1845.	1846.	Mean.	1844.	1845.	1846.	Mean.		1844.	1845.	1846.	Mean.
Prefix.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
Jan.	0068	0112	0110	0097	0128	0164	0138	0143	−0046	0089	0133	0122	0115
Feb.	0140	0134	0167	0147	0119	0097	0142	0119	+0028	0123	0112	0153	0129
Mar.	0109	0048	0098	0085	0175	0077	0079	0110	−0025	0135	0059	0088	0094
April	0079	0090	0098	0089	0107	0171	0099	0126	−0037	0091	0118	0099	0103
May	0124	0110	0104	0113	0155	0176	0088	0140	−0027	0138	0136	0095	0123
June	0091	0082	0123	0099	0162	0088	0144	0131	−0032	0117	0084	0133	0111
July	0092	0098	0191	0127	0115	0091	0127	0111	+0016	0102	0094	0153	0116
Aug.	0084	0090	0161	0112	0078	0168	0116	0121	−0009	0081	0117	0135	0111
Sept.	0066	0124	0292	0161	0118	0144	0183	0148	+0013	0085	0133	0225	0148
Oct.	0117	0114	0158	0130	0126	0084	0172	0127	+0003	0121	0097	0165	0128
Nov.	0115	0109	0168	0131	0084	0194	0112	0130	+0001	0097	0140	0134	0124
Dec.	0113	0209	0053	0125	0070	0167	0105	0114	+0011	0087	0186	0071	0115

TABLE 43.—Mean Diurnal Range of the Vertical Component of Magnetic Force, as deduced from the Ordinary Daily Observations.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Prefix.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1843	0330	0374	0480	0684	0562	0396	0490	0473	0502	0444	0305	0364	0450
1844	0481	0584	1202	1164	0830	0433	0522	0944	0936	1058	1034	0489	0806
1845	0812	0630	0849	0859	0662	0461	0537	0797	0924	0601	0497	0504	0678
1846	0251	0310	0501	0811	0876	0681	1096	1204	1445	1098	0871	0332	0793
1843, 1846	0290	0342	0490	0747	0719	0538	0793	0838	0973	0771	0588	0348	0621
1844, 1845	0646	0607	1025	1011	0746	0447	0529	0870	0930	0829	0765	0496	0742
Mean of all	0468	0474	0758	0879	0732	0493	0661	0854	0952	0800	0677	0422	0682

91. *Annual Variation of the Diurnal Ranges of the Vertical Component of Magnetic Force.*—From the numbers in Table 43, it appears, that the diurnal range of the vertical component is greatest at the equinoxes, and that it is least at the solstices. The values in Table 43 are deduced from the ordinary daily observations in the various years. When we consider the diurnal ranges from *all* the observations made in each of the years 1844 and 1845 (in the manner already noted for the magnetic declination No. 12), we obtain the following means for the several months in each year, (prefix 0·00.)

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	0496	0729	1373	1327	0964	0442	0545	1064	1050	1171	1182	0522	0905
1845,	0943	0686	0934	0924	0697	0464	0546	0820	0961	0634	0540	0560	0726
Mean,	0719	0707	1153	1125	0830	0453	0545	0942	1005	0902	0861	0541	0815

These means give the same law as has already been deduced from Table 43; the values are greater than those for the same years deduced from the ordinary daily observations, but the increase is considerably less than in the cases of the magnetic declination and horizontal component.

Annual Variation of the Ranges of the Monthly Mean Diurnal Variation of the Vertical Component.—In the previous Table we have given the monthly means of the diurnal ranges observed for each day, the following Table contains the diurnal range of the hourly means for each month, those for 1844 and 1845 only being comparable with each other.

TABLE 44.—Ranges of the Mean Diurnal Variation of the Vertical Component of Magnetic Force.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1843	0210	0239	0284	0594	0302	0259	0289	0282	0301	0297	0195	0292	0252
1844	0271	0273	0688	0705	0516	0233	0298	0587	0616	0702	0588	0292	0419
1845	0440	0412	0629	0581	0432	0284	0293	0464	0677	0365	0296	0355	0399
1846	0181	0168	0360	0588	0606	0403	0776	0807	0740	0863	0601	0177	0479
Mean of all	0250	0258	0540	0716	0522	0257	0412	0608	0666	0561	0363	0269	0422

92. The last line of Table 44, which is deduced from observations for the four years, as in Table 48, shews the law already obtained from Table 43, but in a more marked manner. In the corresponding discussions for the declination (No. 14) and for the horizontal component (No. 62), it was found that in the combination of four years' observations, the differences between the diurnal range at the summer solstice, and for the preceding and succeeding months, was considerably diminished; this is not the case for the vertical component; the range at the equinoxes of the hourly mean variation is nearly three times the range at the solstices. When, however, we consider the ranges of the hourly mean variation, as deduced from days selected nearly free from disturbances, we obtain a result similar to that for the other elements. The following are the ranges of the hourly means for each month deduced from the selected days in 1844 and 1845 (see 1844, p. 379, and p. 21 of this volume):—

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
0·00	0124	0124	0180	0186	0223	0238	0196	0190	0257	0209	0167	0132	0136

From these it appears, that the diurnal range of the mean variation, when unaffected by intermittent disturbance, varies little from March to October, the irregularities in the values being due in all probability to disturbance remaining in the selected days.

93. On the whole it is evident for all the three elements, that the law of the variation with season of the range of the hourly variations when unaffected by intermittent disturbance is as follows:—A gradual increase from the winter solstice till the vernal equinox, little variation from the vernal till the autumnal equinox, and a gradual decrease from thence till the winter solstice. Intermittent disturbances increase the diurnal range greatly at the equinoxes, and more at the winter solstice than at the summer solstice.

94. *Annual Variation of the Mean Difference of a Single Observation of the Vertical Component from the Monthly Mean at the corresponding Hour.*—The following mean differences have been obtained from Table L. 1844, p. 389, and Table XLI. p. 23 of this volume:—

Year.	Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	0·000	123	157	294	224	203	144	137	172	191	247	199	123	184
1845,	0·000	192	157	156	175	174	117	137	167	210	139	168	208	167
Mean,	0·000	157	157	225	200	188	130	137	170	200	193	183	165	175

These numbers give the same law as has already been obtained for the other two elements. The mean difference of an observation of the vertical component is greatest at the equinoxes, and least at the solstices (see No. 16).

95. *Annual Variation of the Number of Observations of the Vertical Component which were greater than the Monthly Means for the corresponding Hours.*—The numbers in 100 observations for each month of the years 1844 and 1845 are as follow:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1844,	53·0	49·5	57·7	49·8	52·5	55·7	55·4	52·0	55·0	50·0	46·5	40·7	51·5
1845,	55·7	54·9	55·8	59·3	54·8	51·5	54·3	57·4	50·6	56·3	53·5	43·2	53·9
Mean,	54·4	52·2	56·7	54·5	53·6	53·6	54·8	54·7	52·8	53·1	50·0	41·9	52·7

In the mean of both years, each month, with the exception of November and December, has more observations greater than the monthly mean than it has less, the excess being from 5 to 13 in 100; in November the numbers of positive and negative departures are equal, and in December the greatest difference occurs between the positive and negative departures, the latter being greater than the former by 16 in 100.

MONTHLY VARIATIONS FOR THE VERTICAL COMPONENT.

TABLE 45.—Mean Variations of the Vertical Component of Magnetic Force free from Regular Secular Change, with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	0·00	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00	0·00
14—16	−0016	−0062	−0010	+0020	−0017	27— 1	+0053	+0038	−0005	−0005	+0020
17—20	+0012	−0002	+0012	+0066	+0022	2— 5	+0044	−0008	−0064	+0010	−0004
21—24	+0013	+0044	+0005	+0046	+0027	6— 8	+0008	−0004	+0006	−0047	−0009
25—28	+0031	+0015	−0027	−0031	−0003	9—12	−0018	−0026	+0001	+0003	−0010
29— 1	−0027	+0008	−0022	−0004	−0011	13—15	+0020	+0012	+0011	+0005	+0012
2— 5	−0010	+0010	+0052	−0057	−0001	16—19	−0036	+0004	+0050	−0048	−0007
6— 9	+0027	+0031	+0006	−0023	+0010	20—22	−0048	−0015	+0025	+0034	−0001
10—13	−0028	−0042	−0019	−0016	−0026	23—26	−0028	0000	−0023	+0048	−0001

Variations of the Daily Mean Vertical Component, with reference to the Moon's Age and Declination.—Table 45 has been formed from the Tables in previous volumes, and in this volume, pages 18 and 35; the means for 3 or 4 days are given, positive when greater than the mean for the year, and negative when less.

96. The conclusions from the means of 4 years in Table 45, are,—

1*st*, That the vertical component is a maximum at the quadratures, and a minimum at conjunction and at opposition; the principal maximum occurs about 7 days after opposition, and the secondary maximum about 7 days after conjunction; the difference of the values of the two maxima is due chiefly to the year 1846, the only year which does not exhibit two maxima and two minima.

2*d*, That the vertical component is a maximum when the moon is farthest north, and also when it is farthest south, and between these epochs it is a minimum; the minima occurring when the moon is rather south of the equator. This result is shewn, though with some irregularity, in the numbers for each year. It should be remembered, in glancing over these Tables, that the number which indicates a maximum may have the negative sign, and that which indicates a minimum may have the positive sign; thus, in 1845 the principal maximum occurs about 4 days after the moon's greatest south declination, the secondary maximum occurs when the moon is farthest north, and the minima occur when the moon is about 3 days *north* of the equator.

Variation of the Diurnal Range of the Vertical Component, with reference to the Moon's Age and Declination.—The means of groups of days given in Table 46, have been deduced from the Tables in former volumes, and in this volume, pages 19 and 36.

TABLE 46.—Diurnal Range of the Vertical Component of Magnetic Force, with reference to the Moon's Age and Declination.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	0·00	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00	0·00
14—16	0423	1238	0617	0943	0805	27— 1	0535	0578	0587	0829	0632
17—20	0406	1149	0737	1141	0858	2— 5	0596	0930	0976	0637	0785
21—24	0316	0544	0700	0870	0607	6— 8	0465	0850	0776	0738	0707
25—28	0502	0446	0658	0568	0543	9—12	0384	0657	0681	1113	0709
29— 1	0374	0540	0610	0731	0564	13—15	0503	0626	0482	0637	0562
2— 5	0395	0463	0627	0640	0531	16—19	0382	0773	0767	0518	0610
6— 9	0678	0688	0710	0875	0738	20—22	0349	0872	0475	1068	0691
10—13	0505	1221	0618	0761	0776	23—26	0426	0946	0478	0952	0700

97. From Table 46 we conclude,

1*st*, That the diurnal range of the vertical component is greatest immediately after opposition, and that it is least about conjunction; there is the appearance of a secondary maximum at conjunction in three of the years, and in the means of all.

2*d*, That the diurnal range is a minimum when the moon is farthest south, and also when it is farthest north, and that it is a maximum when the moon is north of the equator.

TABLE 47.—Mean Difference of a Single Observation of the Vertical Component of Magnetic Force, from the Monthly Mean at the corresponding Hour, with reference to the Moon's Age and Declination.

Moon's Age.	1844.	1845.	Mean.	Variations.	After Moon farthest North.	1844.	1845.	Mean.	Variations.
d. d.	0·00	0·00	0·00	0·00	d. d.	0·00	0·00	0·00	0·00
14—16	0219	0143	0181	+0006	27— 1	0171	0148	0159	−0016
17—20	0229	0152	0190	+0015	2— 5	0204	0178	0191	+0016
21—24	0156	0173	0164	−0011	6— 8	0176	0166	0171	−0004
25—28	0151	0186	0168	−0007	9—12	0158	0182	0170	−0005
29— 1	0173	0188	0180	+0005	13—15	0162	0147	0154	−0021
2— 5	0134	0163	0148	−0027	16—19	0206	0193	0199	+0024
6— 9	0185	0166	0175	0000	20—22	0181	0150	0165	−0010
10—13	0240	0157	0198	+0023	23—26	0220	0156	0188	+0013

98. *Variation of the Mean Difference of a Single Observation from the Monthly Mean for the corresponding Hour, with reference to the Moon's Age and Declination.*—Table 47 has been formed from Table 41, p. 386, 1844, and Table XLII., p. 23, of this volume. The conclusions from Table 47 are nearly the same as those already made for the diurnal range, No. 97, they are as follow:—

1*st*, The mean difference of an observation of the vertical component from the monthly mean for the corresponding hour is a maximum about the time of opposition, and a minimum before and after conjunction, a secondary maximum occurring at conjunction.

2*d*, The mean difference is a minimum when the moon is farthest north, and also when farthest south, maxima occurring between these epochs.

The differences of the results for the single years from those for the mean of both are not greater than might be expected in such an investigation; the general agreement of the results, however, with those for the diurnal ranges deduced from four years' observations is a confirmation of their accuracy.

DIURNAL VARIATIONS FOR THE VERTICAL COMPONENT OF MAGNETIC FORCE.

Diurnal Variation of the Vertical Component.—The following Table has been formed in the manner already described for the magnetic declination, No. 26; the means from which it has been formed will be found in the previous volumes, and in this volume, pages 20 and 37.

99. The following are the approximate epochs of the maxima and minima in *apparent* time, as deduced from Table 48.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Max.	+ 7 5	+ 5 25	+ 5 10	+ 6 0	+ 6 0	+ 6 20	+ 5 20	+ 6 0	+ 5 5	+ 4 0	+ 6 15	+ 6 45
Min.	−14 0	−14 0	−14 0	−12 15	−13 45	13 45	−14 10	−13 15	−13 15	−16 30	−13 0	−16 20
Max.			20 15	21 0	19 50	20 0	20 30	20 40	22 0	?		
Min.			0 0	0 15	0 0	− 0 10	23 55	23 40	23 30	?		

The principal maximum occurs between 4^h P.M. and 7^h P.M. in each month of the year; it occurs earliest in February and March of the first six months of the year, and in October and September of the remaining months; it occurs latest in January and December; and later in June than in the immediately preceding and succeeding months. A minimum occurs between midnight and 4^h A.M. throughout the year, which is the principal minimum excepting in June.

Only one maximum and minimum occur in the diurnal variation for the four winter months, November to February; in the other months a secondary minimum occurs about noon, which becomes more distinct the nearer the time is to the summer solstice, when that minimum is better marked than the other near midnight.

TABLE 48.—Diurnal Variations of the Vertical Component of Magnetic Force, as deduced from the Regular Daily Observations made during the Four Years 1843 to 1846.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	0035	0008	0061	0000	0036	0044	0051	0002	0033	0118	0000	0051
13 13	0046	0001	0017	0079	0001	0011	0018	0010	0000	0088	0002	0045
14 13	0000	0000	0000	0091	0000	0012	0000	0000	0042	0060	0008	0016
15 13	0011	0001	0023	0156	0014	0048	0012	0044	0040	0040	0014	0001
16 13	0007	0013	0095	0137	0107	0071	0046	0118	0093	0000	0021	0002
17 13	0008	0010	0125	0194	0181	0091	0059	0179	0144	0048	0031	0000
18 13	0031	0020	0159	0271	0247	0141	0110	0232	0212	0132	0039	0006
19 13	0045	0037	0223	0323	0283	0175	0146	0295	0291	0232	0059	0019
20 13	0067	0044	0280	0374	0286	0183	0165	0327	0329	0304	0092	0040
21 13	0076	0059	0278	0391	0263	0140	0158	0330	0352	0350	0116	0047
22 13	0098	0060	0260	0372	0214	0087	0140	0296	0367	0351	0110	0055
23 13	0128	0072	0241	0358	0182	0012	0082	0240	0344	0350	0129	0078
0 13	0139	0090	0227	0352	0178	0000	0076	0238	0372	0397	0176	0099
1 13	0169	0111	0269	0368	0216	0015	0113	0297	0435	0423	0208	0126
2 13	0203	0151	0358	0446	0286	0058	0169	0381	0529	0481	0242	0166
3 13	0220	0216	0417	0532	0390	0126	0274	0471	0618	0560	0317	0231
4 13	0221	0246	0464	0590	0448	0211	0365	0550	0656	0561	0363	0235
5 13	0241	0258	0540	0696	0513	0243	0412	0596	0666	0536	0340	0249
6 13	0241	0254	0518	0716	0522	0257	0402	0608	0544	0487	0428	0269
7 13	0250	0220	0457	0654	0502	0247	0385	0537	0486	0440	0332	0253
8 13	0244	0204	0383	0518	0432	0227	0319	0434	0380	0373	0242	0181
9 13	0198	0139	0260	0396	0321	0176	0221	0259	0253	0308	0159	0162
10 13	0063	0122	0093	0308	0244	0100	0161	0187	0177	0248	0077	0133
11 13	0018	0023	0120	0224	0176	0055	0102	0041	0108	0172	0029	0086

TABLE 49.—Diurnal Variations of the Vertical Component of Magnetic Force for Different Periods, deduced from Table 48.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0075	−0270	−0143	−0196	−0201	−0138	−0203	−0171
13 13	−0075	−0252	−0177	−0208	−0222	−0148	−0212	−0181
14 13	−0101	−0255	−0177	−0222	−0214	−0157	−0218	−0188
15 13	−0102	−0211	−0152	−0194	−0220	−0161	−0186	−0173
16 13	−0099	−0184	−0094	−0140	−0213	−0156	−0139	−0148
17 13	−0100	−0141	−0047	−0103	−0177	−0138	−0097	−0118
18 13	−0087	−0085	+0011	−0051	−0123	−0105	−0042	−0074
19 13	−0072	−0027	+0046	−0002	−0057	−0064	+0006	−0030
20 13	−0056	+0027	+0051	+0024	−0009	−0032	+0034	0000
21 13	−0045	+0034	+0018	+0022	+0022	−0011	+0025	+0006
22 13	−0035	+0016	−0033	−0004	+0025	−0005	−0007	−0007
23 13	−0013	−0001	−0086	−0061	+0023	+0005	−0049	−0022
0 13	+0003	−0011	−0094	−0065	+0064	+0033	−0057	−0012
1 13	+0029	+0018	−0068	−0017	+0104	+0066	−0022	+0022
2 13	+0067	+0102	−0011	+0053	+0166	+0116	+0048	+0082
3 13	+0116	+0174	+0075	+0150	+0247	+0181	+0133	+0157
4 13	+0128	+0227	+0146	+0235	+0276	+0202	+0203	+0202
5 13	+0143	+0318	+0195	+0282	+0263	+0203	+0265	+0234
6 13	+0149	+0317	+0206	+0283	+0235	+0192	+0269	+0230
7 13	+0135	+0255	+0191	+0239	+0168	+0151	+0228	+0190
8 13	+0104	+0150	+0146	+0154	+0081	+0092	+0150	+0121
9 13	+0060	+0028	+0065	+0018	−0011	+0024	+0037	+0031
10 13	0000	−0100	−0011	−0048	−0084	−0042	−0053	−0048
11 13	−0064	−0128	−0068	−0151	−0148	−0106	−0116	−0111

100. When we combine the means in groups in the manner already adopted for the magnetic declination, No. 31, we obtain the following epochs of maxima and minima in *apparent* time (see Plate III.)

	Dec. Jan. Feb.	March, April,	May, June,	July, Aug.	Sept. Oct. Nov.
Maximum,	5h 50m P.M.	5h 40m P.M.	6h 0m P.M.	5h 40m P.M.	4h 25m P.M.
Minimum,	3h 40m A.M.	12h 10m A.M.	1h 45m A.M.	2h 10m A.M.	2h 30m A.M.
Maximum,		8h 40m A.M.	8h 0m A.M.	8h 35m A.M.	
Minimum,		0h 0m Noon.	0h 0m Noon.	11h 45m A.M.	

The conclusions from the epochs for these groups are quite similar to those already obtained from the epochs for the single months. The afternoon maximum occurs earliest in September to November.

TABLE 50.—Diurnal Variations of the Vertical Component of Magnetic Force for Different Periods, deduced from Days selected as free from Irregular Disturbances, in the Years 1844 and 1845.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0018	−0065	−0063	−0069	−0079	−0048	−0066	−0057
13 13	−0023	−0069	−0056	−0071	−0081	−0052	−0065	−0058
14 13	−0028	−0038	−0038	−0060	−0070	−0049	−0045	−0047
15 13	−0035	−0026	−0003	−0031	−0067	−0051	−0020	−0035
16 13	−0040	−0032	+0030	+0011	−0063	−0051	+0003	−0024
17 13	−0045	−0022	+0060	+0038	−0057	−0051	+0025	−0013
18 13	−0049	+0003	+0077	+0068	−0043	−0046	+0049	+0001
19 13	−0050	+0029	+0083	+0075	−0013	−0031	+0062	+0016
20 13	−0035	+0058	+0071	+0058	+0014	−0010	+0062	+0026
21 13	−0034	+0052	+0017	+0030	+0021	−0006	+0033	+0013
22 13	−0025	+0017	−0047	−0004	+0002	−0011	−0011	−0011
23 13	−0014	−0034	−0112	−0071	−0012	−0013	−0072	−0043
0 13	−0003	−0084	−0126	−0099	−0018	−0010	−0103	−0057
1 13	+0015	−0058	−0099	−0081	+0014	+0014	−0079	−0032
2 13	+0043	−0008	−0053	−0040	+0068	+0055	−0034	+0010
3 13	+0065	+0026	−0007	+0018	+0106	+0085	+0012	+0049
4 13	+0066	+0070	+0045	+0071	+0119	+0092	+0062	+0077
5 13	+0049	+0083	+0072	+0086	+0100	+0074	+0080	+0077
6 13	+0040	+0070	+0078	+0077	+0072	+0056	+0075	+0065
7 13	+0039	+0051	+0065	+0049	+0049	+0044	+0055	+0049
8 13	+0036	+0033	+0051	+0031	+0038	+0037	+0038	+0037
9 13	+0038	+0020	+0018	−0005	+0004	+0021	+0011	+0016
10 13	+0019	−0021	−0022	−0029	−0026	−0003	−0024	−0014
11 13	−0014	−0053	−0052	−0063	−0072	−0043	−0056	−0049

101. When we consider the diurnal variation as deduced from days selected as nearly free from intermittent disturbance (No. 85), and as exhibited in the means, Table 50, and the dotted curves, Plate III., we find that the epochs of maximum are considerably altered as well as the whole form of the diurnal curve. The epochs of maxima and minima in *apparent* time are as follow :—

	Dec. Jan. Feb.	March, April,	May, June,	July, Aug.	Sept. Oct. Nov.
Maximum,	3h 40m P.M.	5h 10m P.M.	6h 0m P.M.	5h 10m P.M.	4h 10m P.M.
Minimum,	6h 40m A.M.	1h 0m A.M.	12h 20m A.M.	12h 40m A.M.	12h 55m A.M.
Maximum,		8h 30m A.M.	7h 0m A.M.	6h 55m A.M.	9h 10m A.M.
Minimum,		0h 20m P.M.	0h 0m Noon.	0h 20m P.M.	0h 5m P.M.

Hence, in the undisturbed diurnal variation, the maximum of the vertical component occurs earliest in the months December to February, and latest in the months May and June.

The form of the diurnal curve is quite different in the months November to February, from that for the other months : in the four winter months the diurnal curve is single, having but one maximum and minimum,

the latter occurring about 7^h A.M., which is nearly the epoch of a maximum in the other months : in the months from March to September the diurnal curve is double, the maxima having nearly the same value in each month, and the minima also being nearly equal ; the form of the diurnal curve from March to September is nearly constant ; in October the morning maximum becomes less marked, and it wholly disappears in November. In June the minima occur almost exactly at apparent midnight and noon, that at the latter time being on the whole best marked ; the maxima occur when the sun is near the prime vertical.

102. *Diurnal Variation of the Effect of Disturbance on the Mean Vertical Component.*—The following Table contains the mean effect of disturbance upon the hourly means in each group of months, the assumption being made that the effects of disturbance upon the means of the groups of months are zero ; it will be seen from Nos. 89 and 85 that the means of the days selected as free from disturbance, are rather greater than the means for all the days ; while this difference may be partially due to regular laws, it is also so small, compared with the actual differences in the following Table, that the epochs for the zero of effect would be little altered if it were taken into account. It will be seen also that the epochs for each group vary little, though the effect of disturbance, as found No. 89, differs considerably in the different groups ; thus, for the group December to February, the mean for all the selected days is 0·000005 greater than the mean for all the days, while the mean of the selected days in March and April is 0·000061 less than the mean for all.

TABLE 51.—Differences of Disturbed and Undisturbed Diurnal Variations of the Vertical Component of Magnetic Force, as deduced from Tables 49 and 50, exhibiting the effect of Irregular Disturbance on the Hourly Mean Positions.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0057	−0205	−0080	−0127	−0122	−0090	−0137	−0114
13 13	−0052	−0183	−0121	−0137	−0141	−0096	−0147	−0123
14 13	−0073	−0217	−0139	−0162	−0144	−0108	−0173	−0141
15 13	−0067	−0185	−0149	−0163	−0153	−0110	−0166	−0138
16 13	−0059	−0152	−0124	−0151	−0150	−0105	−0142	−0124
17 13	−0055	−0119	−0107	−0141	−0120	−0087	−0122	−0105
18 13	−0038	−0088	−0066	−0119	−0080	−0059	−0091	−0075
19 13	−0022	−0056	−0037	−0077	−0044	−0033	−0056	−0046
20 13	−0021	−0031	−0020	−0034	−0023	−0022	−0028	−0026
21 13	−0011	−0018	+0001	−0008	+0001	−0005	−0008	−0007
22 13	−0010	−0001	+0014	0000	+0023	+0006	+0004	+0004
23 13	+0001	+0033	+0026	+0010	+0035	+0018	+0023	+0021
0 13	+0006	+0073	+0032	+0034	+0082	+0043	+0046	+0045
1 13	+0014	+0076	+0031	+0064	+0090	+0052	+0057	+0054
2 13	+0024	+0110	+0042	+0093	+0098	+0061	+0082	+0072
3 13	+0051	+0148	+0082	+0132	+0141	+0096	+0121	+0108
4 13	+0062	+0157	+0101	+0164	+0157	+0110	+0141	+0125
5 13	+0094	+0235	+0123	+0196	+0163	+0129	+0185	+0157
6 13	+0109	+0247	+0128	+0206	+0163	+0136	+0194	+0165
7 13	+0096	+0204	+0126	+0190	+0119	+0107	+0173	+0141
8 13	+0068	+0117	+0095	+0123	+0043	+0055	+0112	+0084
9 13	+0022	+0008	+0047	+0023	−0015	+0003	+0026	+0015
10 13	−0019	−0079	+0011	−0019	−0058	−0039	−0029	−0034
11 13	−0050	−0075	−0016	−0088	−0076	−0063	−0060	−0062

103. The following are the conclusions from Table 51.

1*st*, The greatest effect of disturbance in increasing the vertical component occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$6^h\ 15^m$ P.M.	$6^h\ 0^m$ P.M.	$6^h\ 30^m$ P.M.	$6^h\ 0^m$ P.M.	$5^h\ 30^m$ P.M.

Throughout the year, therefore, the greatest effect of disturbance in increasing the vertical component occurs near 6^h P.M. or about the epoch of the maximum for the mean value, No. 100.

2*d*, The greatest effect of disturbance in diminishing the vertical component occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$2^h\ 30^m$ A.M.	$1^h\ 40^m$ A.M.	$2^h\ 50^m$ A.M.	$2^h\ 45^m$ A.M.	$3^h\ 30^m$ A.M.

The greatest effect in diminishing the vertical component occurs throughout the year between $1\frac{3}{4}^h$ and $3\frac{1}{2}^h$ A.M., or rather after the epoch of the principal minimum for the mean value, No. 100. Irregular disturbance, therefore, has the same effect on the value of the vertical component as the cause producing the regular diurnal variation.

3*d*, The effect of disturbance on the vertical component is zero

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	11^h A.M. & $9\frac{3}{4}^h$ P.M.	10^h A.M. & $9\frac{1}{2}^h$ P.M.	9^h A.M. & $10\frac{1}{2}^h$ P.M.	$10\frac{1}{4}^h$ A.M. & $9\frac{3}{4}^h$ P.M.	$9\frac{1}{4}^h$ A.M. & 9^h P.M.

The effect of disturbance on the hourly mean appears to be zero about the time the sun is on the magnetic meridian.

Diurnal Variation of Frequency of the Positive Departures from the Hourly Mean Positions.—The number of observations which were in excess of the hourly mean for each month in 1844 and 1845 having been obtained, the means for groups of months were taken, and the following Table was formed.

TABLE 52.—Numbers in 100 Observations of the Vertical Component of Magnetic Force which were greater than the corresponding Hourly Means, deduced from all the Hourly Observations in 1844 and 1845.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.						h. m.					
12 13	55·7	70·1	58·2	67·1	62·8	0 13	46·8	45·5	49·4	40·5	45·5
13 13	56·3	66·2	58·2	67·1	61·9	1 13	47·5	46·1	51·9	40·5	46·5
14 13	62·0	71·4	62·0	67·1	65·6	2 13	43·0	42·9	54·4	41·8	45·5
15 13	58·2	70·8	62·0	66·5	64·4	3 13	34·8	36·4	51·3	39·2	40·4
16 13	58·9	72·7	63·3	64·6	64·9	4 13	34·8	35·1	46·8	39·2	39·0
17 13	57·0	70·1	62·0	65·8	63·7	5 13	32·3	33·1	45·6	35·4	36·6
18 13	57·0	64·9	58·9	66·5	61·8	6 13	29·7	35·7	48·1	35·4	37·2
19 13	53·2	57·8	55·7	58·2	56·2	7 13	32·9	38·3	46·2	41·1	39·6
20 13	51·3	59·1	53·8	54·4	54·6	8 13	38·6	45·5	49·4	50·0	45·9
21 13	53·8	56·5	57·0	50·6	54·5	9 13	44·3	54·5	52·5	62·0	53·3
22 13	53·8	52·6	53·2	51·9	52·9	10 13	53·8	60·4	53·8	62·7	57·7
23 13	50·0	50·0	48·7	48·7	49·3	11 13	57·0	64·3	54·4	68·4	61·0

104. The following are the epochs of maximum and minimum *frequency* of the positive departures for each quarter.

	Nov. Dec. Jan.	Feb. Mar. April.	May, June, July.	Aug. Sept. Oct.
Maximum,	11^h P.M.—2^h A.M.	2^h—4^h A.M.	2^h—5^h A.M.	11^h P.M.—6^h A.M.
Minimum,	5^h P.M.	5^h P.M.	5^h P.M.	$5\frac{3}{4}^h$ P.M.

It appears, therefore, that the number of positive departures from the mean of all the observations for the hour is least about 5^h P.M., or about the time that the effect of disturbance in increasing the hourly mean is greatest, and that the number is greatest when the effect of disturbance in diminishing the hourly mean is least, No. 103 : the effect of disturbance on the hourly mean position is so considerable when compared with the whole diurnal variation, that it is evident that the number of departures from the *undisturbed* positions must have their maximum about 5^h P.M. and their minimum about 2^h—3^h A.M.

Diurnal Variation of the Mean Differences of the Value of the Vertical Component from its Monthly Mean Value at the corresponding Hour.—Table 53 has been formed from Table LIII., for 1844, p. 387, and Table XLIII., p. 24 of this volume, in the manner already described, No. 43, for Table 18.

TABLE 53.—Mean Difference of the Observations of the Vertical Component of Magnetic Force, in 1844 and 1845, from the Monthly Means at the corresponding Hours in each Year, as deduced from all the Regular Observations.

Mak. Mean Time.	Mean Positive Difference.					Mean Negative Difference.					Mean Difference.				
	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	0159	0229	0151	0187	0183	0199	0533	0208	0379	0311	0177	0320	0175	0250	0230
13 13	0147	0222	0183	0187	0185	0191	0431	0252	0379	0303	0166	0293	0212	0250	0230
14 13	0138	0226	0173	0197	0185	0259	0567	0283	0400	0352	0171	0323	0215	0264	0243
15 13	0142	0203	0180	0206	0184	0196	0497	0293	0409	0334	0165	0288	0223	0274	0237
16 13	0136	0185	0151	0214	0172	0195	0487	0263	0389	0320	0160	0268	0192	0276	0224
17 13	0139	0173	0145	0181	0161	0185	0403	0237	0351	0281	0159	0242	0180	0239	0205
18 13	0135	0148	0140	0153	0144	0179	0274	0201	0304	0236	0154	0192	0165	0204	0179
19 13	0134	0124	0134	0143	0134	0151	0171	0167	0198	0170	0142	0144	0149	0166	0150
20 13	0133	0101	0131	0130	0124	0141	0145	0154	0156	0148	0137	0119	0142	0142	0135
21 13	0125	0097	0121	0120	0116	0147	0126	0160	0122	0138	0135	0110	0138	0121	0126
22 13	0120	0101	0122	0111	0113	0141	0112	0137	0120	0128	0130	0106	0129	0115	0120
23 13	0120	0115	0132	0112	0119	0120	0115	0124	0106	0117	0120	0115	0128	0109	0118
0 13	0137	0157	0123	0163	0145	0122	0131	0121	0111	0121	0129	0143	0122	0132	0132
1 13	0140	0146	0115	0180	0143	0127	0124	0125	0123	0124	0133	0134	0120	0146	0133
2 13	0163	0174	0113	0183	0156	0123	0132	0135	0133	0130	0140	0150	0123	0154	0142
3 13	0289	0251	0131	0246	0220	0155	0144	0139	0157	0151	0202	0183	0135	0192	0178
4 13	0333	0260	0166	0282	0254	0179	0140	0147	0180	0162	0233	0182	0156	0220	0198
5 13	0392	0368	0182	0359	0315	0189	0181	0152	0198	0181	0255	0243	0166	0255	0230
6 13	0447	0341	0164	0285	0292	0187	0188	0151	0157	0171	0264	0242	0157	0202	0216
7 13	0336	0227	0152	0213	0225	0166	0142	0130	0148	0147	0222	0175	0140	0175	0178
8 13	0209	0153	0124	0131	0151	0131	0128	0122	0131	0129	0161	0139	0123	0131	0139
9 13	0172	0131	0108	0110	0127	0138	0157	0119	0180	0146	0153	0143	0113	0137	0136
10 13	0150	0160	0103	0114	0132	0176	0246	0121	0189	0179	0162	0194	0111	0142	0152
11 13	0150	0150	0115	0148	0142	0199	0273	0137	0322	0222	0171	0194	0125	0203	0173

105. The approximate epochs of maxima and minima for the mean positive and negative differences, the principal being indicated by + and −, are as follow :—

	Mean Positive Difference.				Mean Negative Difference.			
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Nov. Dec. Jan.	$-10\frac{1}{2}^h$ A.M.	$+6\frac{1}{4}^h$ P.M.	.....	.....	− 0h Noon.	$5\frac{3}{4}^h$ P.M.	$8\frac{1}{2}^h$ P.M.	$+2\frac{1}{2}^h$ A.M.
Feb. Mar. April,	$-9\frac{1}{4}^h$ A.M.	$+5\frac{1}{2}^h$ P.M.	9h P.M.	1h A.M.	$-10\frac{1}{2}^h$ A.M.	6h P.M.	$8\frac{1}{2}^h$ P.M.	$+2\frac{1}{2}^h$ A.M.
May, June, July,	2h P.M.	+5h P.M.	−10h P.M.	+2h A.M.	− 0h Noon.	$5\frac{3}{4}^h$ P.M.	−9h P.M.	$+2\frac{3}{4}^h$ A.M.
Aug. Sept. Oct.	$-10\frac{1}{2}^h$ A.M.	+5h P.M.	$-9\frac{1}{2}^h$ P.M.	4h A.M.	$-11\frac{1}{2}^h$ A.M.	5h P.M.	8h P.M.	+3h A.M.

106. The mean positive difference has two maxima and two minima in each quarter excepting winter; the principal maximum occurs between 5h and 6h P.M.; in summer the two maxima have an equal value; the values of the two minima differ little.

107. The mean negative difference has two maxima and two minima in each quarter; the principal maximum occurs between 2h and 3h A.M.; in winter the two maxima differ little in value; in the other quarters the secondary maximum is very small compared with the other; the values of the two minima in each quarter differ little.

108. It appears, therefore, that the principal maximum of the mean positive difference occurs at the same time as the secondary maximum of the mean negative difference, and *vice versa*. It seems probable that if differences were taken with reference to mean *undisturbed* positions, the secondary maximum would disappear in each case; thus, if we consider that the effect of disturbance is to increase the mean vertical component to a large extent about 6h P.M. (No. 103, 1*st*), it is obvious that both the value and the number of the negative departures from this increased mean will be greater than if the undisturbed mean were taken as the zero. It was accordingly found in the discussion of the observations for 1844, (pp. 388, 389), when the mean position was employed as deduced from the days selected nearly free from intermittent disturbance, that the maximum of

the mean positive disturbance occurred about 6^h P.M., the minimum between 11^h P.M. and 8^h A.M.; that the maximum of the mean negative disturbance occurred about 2^h A.M. and the minimum about 6^h P.M., although the values varied little between noon and 8 P.M.

109. The approximate epochs of maxima and minima for the mean disturbance, independent of sign, (indicating the principal maximum by + and minimum by −), are as follow:—

	Min.	Max.	Min.	Max
Winter—Nov. Dec. Jan.	-11^h A.M.	$+6^h$ P.M.	9^h P.M.	1^h A.M.
Spring—Feb. March, April,	-10^h A.M.	$5\frac{1}{2}^h$ P.M.	$8\frac{1}{2}^h$ P.M.	$+1\frac{1}{2}^h$ A.M.
Summer—May, June, July,	1^h P.M.	5^h P.M.	-10^h P.M.	$+3^h$ A.M.
Autumn—Aug. Sept. Oct.	-11^h A.M.	5^h P.M.	$8\frac{1}{2}^h$ P.M.	$+3\frac{3}{4}^h$ A.M.

It has been seen that the positive disturbance has its maximum about 5^h—6^h P.M., and the negative disturbance its maximum about 2^h A.M., so it appears now that the mean disturbance, independent of sign, has a maximum near both hours.

110. In winter the secondary maximum, about 1^h A.M., is very indistinctly marked; in summer the secondary maximum, about 5^h P.M., is very small compared with the other; the principal minimum occurs in winter about 11^h A.M.; that at 10^h P.M. is best marked in summer. In this case also, as in the cases of the magnetic declination, No. 45, and the horizontal component, No. 77, the diurnal variation of the magnetic disturbance in summer *is nearly the reverse of that in winter*. The diurnal variation of the disturbance is very nearly the same in spring as in autumn.

TABLE 54.—Variations of the Vertical Component of Magnetic Force with reference to the Moon's Hour-Angle for the Winter and Summer Lunations, and for all the Lunations of the Years 1844 and 1845.

Moon's Hour-Angle.	Winter Lunations.			Summer Lunations.			All the Lunations.		
	1844.	1845.	Mean.	1844.	1845.	Mean.	1844.	1845.	Mean.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
0 0	−0054	+0002	−0026	+0017	+0007	+0012	−0019	+0005	−0007
2 25	−0086	+0013	−0036	−0009	+0015	+0003	−0047	+0014	−0016
4 20	−0069	−0039	−0054	−0014	+0013	0000	−0042	−0015	−0028
6 15	−0071	−0029	−0050	−0022	+0002	−0010	−0046	−0014	−0030
8 10	−0058	−0031	−0044	−0031	−0019	−0025	−0045	−0025	−0035
10 5	−0007	+0002	−0002	−0009	−0001	−0005	−0008	+0001	−0003
12 0	+0059	+0030	+0045	−0018	+0010	−0004	+0020	+0021	+0020
13 55	+0107	+0038	+0072	+0007	+0020	+0013	+0058	+0030	+0044
15 50	+0094	+0036	+0065	+0039	+0001	+0020	+0067	+0020	+0043
17 45	+0049	−0021	+0035	+0017	−0020	−0001	+0033	+0002	+0017
19 40	+0043	−0014	+0014	+0007	−0028	−0010	+0025	−0021	+0002
21 35	−0004	−0025	−0014	+0015	0000	+0007	+0006	−0013	−0003

111. *Variation of the Vertical Component with reference to the Moon's Hour-Angle.*—There are four independent results in Table 54, namely two for the winter lunations, and two for the summer lunations of 1844 and 1845, the others depend on these. In all the four the maximum vertical component occurs between 2 and 4 hours after the moon's transit of the inferior meridian; in three cases a secondary maximum occurs at, or shortly after the superior transit,—minima occurring during the intermediate period, from 6 to 8 hours after, and from 2 to 4 hours before, the superior transit; in the winter lunations for 1844, only the principal maximum and minimum are shewn (see the similar case for the horizontal component No. 80), and, as the variations for this group are much greater than for any of the others, it is probable that the difference is due to disturbances. See the volumes for 1844, p. 382, where the elimination of the larger disturbances leaves traces of a secondary maximum and minimum.

112. From the means of all the winter lunations in Table 54

The vertical component is a maximum about 2 hours after the moon's inferior transit.
.....minimum.....5 hours after the moon's superior transit.

The means of all the summer lunations indicate that

The vertical component is a principal maximum about $3\frac{1}{2}$ hours after the moon's inferior transit.
....minimum.....8 hours.....superior transit.
..... a secondary maximum near the moon's superior transit.
.....minimum about 5 hours before the moon's superior transit.

This last result serves very nearly for the mean of all the lunations in 1845, and for the mean of all the lunations in 1844, when the larger disturbances have been rejected as in the place cited above.

MAGNETIC DIP.

113. Observations for the absolute value of the magnetic dip were made with an instrument by Robinson in the years from 1841 to 1849 ; those till May 1843 were made with the instrument on a pillar near the declinometer (see Introduction, 1843, p. liv.) ; from June 1843 till February 1846, the observations were made in a small wooden house erected for the purpose about 19 yards north of the Observatory dip-pillar. The observations after June 1843 were in general very unsatisfactory ; and ultimately, in February 1846, the observations were discontinued (see section Inclinometer, in the Introductions to the various volumes, for details.) In order to determine the annual change of dip, the inclinometer was placed on the original dip-pillar in the Observatory in September 1849 ; previously, it was found, that both needles belonging to the instrument were much disfigured by rust ; the rust was removed as carefully as possible and the needles rebalanced.

114. The following are the results of the observations, which were very satisfactory :—

Sept.	$28^d\ 23^h$	Needle No. 1.	Dip = 71° 15′·93
	$29^d\ 0^h$	.....	Dip = 71° 14′·87
	$29^d\ 2^h$	Needle No. 2.	Dip = 71° 16′·96
	$29^d\ 5^h$	.....	Dip = 71° 16′·27

115. The dip resulting from these observations differing to a considerable extent from that obtained previously in the dip-house, the inclinometer was removed to that place in order to determine the value of the difference. It was found that the dip obtained on the Observatory pillar, was nearly five minutes less than that shewn in the dip-house. Other observations were made immediately outside the Observatory, on the top, and at the NW. foot of the Observatory hill, which agreed almost exactly with those made on the Observatory pillar. The details of these observations must be reserved for another occasion ; it is believed, however, that the difference found for the first two places of observation is due to the wall of a sunk fence built of trap stones, which passes within about 2 yards of the instrument when in the dip-house, the top of the wall being on a level with the surface of the ground. The following then are the means of all the observations of magnetic dip made with the Makerstoun inclinometer ; the observations made in the dip-house between June 1843 and February 1846, having been corrected by − 5′.

TABLE 55.—Mean Value of the Observations of Magnetic Dip.

Dates.	Mean Epoch.	No. of Observations.	Position of Inclinometer.	Mean of Observed Dips.
				° ′
July —Dec. 1841	1841·8	27	Observatory Dip-Pillar	71 25·90
Jan. —Dec. 1842	1842·5	86		23·95
Jan. —June 1843	1843·2	36		22·14
June—Dec. 1843	1843·7	48	Dip-house	20·20
Jan. —Dec. 1844	1844·5	67		23·69
Jan. —Dec. 1845	1845·5	82		23·10
Jan. —Feb. 1846	1846·1	12		22·40
Oct. 1849	1849·7	4	Observatory Dip-Pillar	16·00

116. The observations made in the years 1841–2–3 on the Observatory dip-pillar, give for the mean epoch 1842·5, the mean dip = 71° 24′·0 ; those made on the same pillar 1849·7, give the mean dip = 71° 16′·0 ; whence the change in 7·2 years = − 8′·0, or = − 1′·11 a year.

117. The observations made in different azimuths already noticed, render it probable that the dip deduced above is inaccurate from instrumental causes; the mean dip from observations in all the azimuths was less than that from the observations in the magnetic meridian by upwards of 10′.

118. In order if possible to determine the true dip, the inclinometer belonging to the Royal Society of Edinburgh was obtained, and observations were made with it on the Observatory dip-pillar as follow:—

Sept. $25^d\ 5^h$	Needle No. 1.	Dip = 71° 11′·38	Mean Dip = 71° 10′·36
$26^d\ 1^h$	.....	Dip = 71° 10′·83	
$26^d - 27^d$	Needle No. 2.	Dip = 71° 8′·88	

The instrument was not in good order and a considerable time was spent on the observations; but the results agree very well. Observations with needle No. 2, were also made in the azimuths 30° and 120°, which gave the following values:—

By the Formula for single Azimuths.		By the Formula for both Azimuths.
Azimuth 30°	Dip = 71° 9′·87	Azimuths 30° and 120°, Dip = 71° 4′·2
..... 120°	Dip = 70° 47′·7	

The observations with the Royal Society's inclinometer in the magnetic meridian give the magnetic dip about 6′ less than those with the Makerstoun instrument. It cannot be said that the true dip for Makerstoun is yet accurately determined, as the observations with the Royal Society's inclinometer in different azimuths will scarcely permit the assumption that it is free from instrumental error.

119. The following results are deduced from those already obtained for the horizontal and vertical components of magnetic force. (See 1844, p. 390.) It may be remarked here, that the epochs for the horizontal component and magnetic dip agree very nearly in every case where both have been determined; maxima of the horizontal component being equivalent to minima of dip, and *vice versa;* therefore, when investigations have not been made similar to those for the horizontal component for the magnetic dip (such as for the mean difference or disturbance), the law for the former may be assumed for the latter, and the values of the variations of dip in minutes may be obtained approximately from the numbers for the horizontal component by multiplying the latter by 1000.

120. *Secular Change of Magnetic Dip.*—If we assume the secular change for the horizontal component = + 0·001318 (No. 52), and for the vertical component, as deduced from the years 1845–9, = − 0·001055, we find the secular change of dip = − 2′·47; this is considerably greater than that obtained from the observations of absolute dip No. 116; since the secular change for the horizontal component must be near the truth (No. 53), and that obtained for the dip, No. 116, cannot be far from it, it is probable that the secular change for the vertical component is still considerably in error, that in fact the balance needle is still losing magnetism.

121. *Effect of Disturbance on the Yearly Mean.*—From the means for the days selected as nearly free from disturbance in the years 1844 and 1845, we find from Nos. 54 and 85, that the yearly mean of magnetic dip deduced from the undisturbed days is less than that from all the observations by 0′·15. The effect of disturbance, therefore, is to increase the magnetic dip, although the effect on the magnetic declination is nearly zero. (No. 38.)

122. *Annual Period of Magnetic Dip.*—This result depends chiefly on that for the horizontal component; adopting the annual period for the vertical component, deduced from the observations for the years 1843–6, as the best representative of that variation, and employing the annual variations for the horizontal component, deduced from the observations in the years 1843–6, 1842–5, and 1842–7, we obtain the following numbers:

TABLE 56.—Monthly Variations of Magnetic Dip, free from Regular Secular Change.

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	′	′	′	′	′	′	′	′	′	′	′	′
1843–6	−0·131	−0·167	+0·102	+0·207	−0·258	−0·256	−0·209	+0·174	+0·400	+0·331	+0·020	−0·200
1842–5	−0·101	−0·110	+0·111	+0·311	−0·287	−0·355	−0·147	+0·116	+0·282	+0·211	+0·056	−0·088
1842–7	−0·263	−0·161	+0·035	+0·302	−0·350	−0·516	−0·278	+0·209	+0·502	+0·642	+0·199	−0·320

The variations of each of these groups of years exhibit a law which may be thus stated :—*The magnetic dip is greatest near the eqinoxes, and it is least near the solstices.* The variations for the years 1842–5 are perhaps least affected by disturbances ; for these years the two maxima have nearly equal values, but the minimum at the summer solstice is greater than that at the winter solstice : in the variations for the years 1843–6 the two minima have nearly equal values, but the two maxima are unequal, the maximum at the autumnal equinox being greatest (See Plate VI.) : and in the variations for the years 1842–7, both maxima and minima are unequal ; the greatest maximum occurring at the autumnal equinox, and the greatest minimum at the summer solstice. The same results are to be obtained for the annual period of the horizontal component, the differences depending upon the amount of disturbance in the different groups of years.

123. When we deduce the monthly means of magnetic dip from the observations of the two component magnetometers, made on the days selected as nearly free from irregular disturbance, in the years 1844 and 1845, we find the means from all the hourly observations in those years greater (+) or less (−) than the former by the following quantities. (See Nos. 57 and 59.)

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
+ 0′·158	+ 0′·294	+ 0′·258	+ 0′·196	− 0′·037	− 0′·026	− 0′·032	+ 0′·060	+ 0′·038	+ 0·348	+ 0′·150	+ 0′·356

The effect of disturbance on the monthly mean magnetic dip is negative in the three months May to July, and is positive in the remaining months. If these means be subtracted from those for the corresponding months in Table 56, it will be found that the annual period from the undisturbed days has the same epochs as that from the disturbed days. (See No. 58.)

124. *Annual Variation of the Ranges of the Monthly Mean Variation of Dip.*—The following are the ranges of the mean variation for each month, from four years' observations, as obtained from Table 57.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1′·10	0′·72	2′·06	3′·26	3′·82	3′·71	4′·04	3′·88	2′·92	2′·39	1′·46	1′·01

The range of dip was least in February, and in the three months December, January, and February; it was greatest in July, and in the months from May to August, the range for June being slightly less than for May, July, and August. The following are the ranges of the mean variation, obtained from the observations on the selected days of 1844 and 1845.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0′·53	0′·62	1′·85	3′·27	3′·25	3′·26	3′·04	3′·23	3′·10	1′·94	1′·38	1′·05

The range of the nearly undisturbed mean diurnal variation is least in January, and it is nearly constant in the months from April to September. (See No. 93.)

125. *Variations of the Daily Mean Magnetic Dip with reference to the Moon's Age.*—The following numbers, the means for groups of days from four years' observations, are obtained from the last column of the first parts of Tables 28 and 45.

Moon's Age.	14^d—16^d	17^d—20^d	21^d—24^d	25^d—28^d	29^d—1^d	2^d—5^d	6^d—9^d	10^d—13^d
Variations,	+ 0′·069	+ 0′·147	+ 0′·034	− 0′·137	− 0′·123	− 0′·088	+ 0′·012	+ 0′·085

These numbers shew that the magnetic dip was greatest immediately after opposition, and that it was least immediately before conjunction.

126. *Variations of the Daily Mean Magnetic Dip with reference to the Moon's Declination.*—The following numbers, also derived from four years' observations, are obtained from the last columns of Table 28 and 45.

Day after Moon farthest North.	27^d—1^d	2^d—5^d	6^d—8^d	9^d—12^d	13^d—15^d	16^d—19^d	20^d—22^d	23^d—26^d
Variations,	− 0′·043	+ 0′·003	+ 0′·072	+ 0′·004	− 0′·051	− 0′·027	+ 0′·001	+ 0′·038

It appears therefore, that a minimum of magnetic dip occurred when the moon was farthest north, another minimum occurred when it was farthest south, and maxima occurred when the moon was near the equator. This law is exactly the same as that for the annual variations. No. 122.

127. *Monthly Variations of the Range of Dip.*—These and the analogous results for the mean difference cannot be derived from Tables 29, 30, and 46, 47, but require the conversion of all the hourly observations

into dip, reductions which have not been performed, the laws for the dip however are quite the same as those for the horizontal component, to which we refer. See also No. 141.

Diurnal Variation of the Magnetic Dip.—The following Table is deduced from Tables 31 and 48.

TABLE 57.—Diurnal Variations of Magnetic Dip for each Month, as deduced from the Regular Daily Observations made during the Four Years 1843 to 1846.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. m.	′	′	′	′	′	′	′	′	′	′	′	′
12 12	0·658	0·294	0·214	1·061	1·743	1·332	1·509	0·964	0·755	0·407	0·466	0·878
13 12	0·724	0·449	0·773	1·131	1·782	1·506	1·670	1·278	0·592	0·352	0·426	0·744
14 12	1·096	0·578	0·861	1·767	1·899	1·647	1·804	1·433	0·930	0·371	0·462	0·708
15 12	0·452	0·525	0·478	1·404	1·989	1·774	1·914	1·470	0·743	0·070	0·277	0·588
16 12	0·214	0·409	0·567	1·303	2·170	1·918	2·129	1·550	0·750	0·000	0·156	0·298
17 12	0·000	0·127	0·538	1·113	2·200	2·120	2·320	1·908	0·635	0·157	0·099	0·104
18 12	0·032	0·040	0·317	1·282	2·373	2·515	2·518	2·131	0·986	0·440	0·000	0·000
19 12	0·080	0·030	0·696	1·631	2·840	2·883	2·925	2·776	1·756	0·789	0·234	0·152
20 12	0·366	0·164	1·344	2·479	3·455	3·413	3·485	3·548	2·312	1·557	0·669	0·373
21 12	0·534	0·610	1·759	3·133	3·744	3·706	3·963	3·880	2·884	2·200	1·273	0·687
22 12	0·836	0·720	2·060	3·264	3·817	3·655	4·042	3·699	2·924	2·388	1·457	0·983
23 12	0·767	0·689	1·824	3·112	3·353	3·039	3·459	3·040	2·348	2·092	1·369	1·008
0 12	0·662	0·473	1·369	2·430	2·633	2·230	2·676	2·311	1·610	1·653	0·937	0·929
1 12	0·302	0·217	0·693	1·640	1·762	1·554	2·022	1·371	0·829	0·920	0·693	0·713
2 12	0·239	0·000	0·336	1·052	1·260	0·974	1·197	1·041	0·467	0·710	0·527	0·558
3 12	0·278	0·009	0·070	0·632	0·935	0·689	0·599	0·544	0·210	0·399	0·496	0·539
4 12	0·227	0·159	0·000	0·368	0·189	0·472	0·372	0·409	0·000	0·445	0·652	0·477
5 12	0·312	0·242	0·134	0·007	0·000	0·191	0·114	0·000	0·133	0·387	0·208	0·512
6 12	0·444	0·238	0·292	0·000	0·107	0·000	0·000	0·126	0·168	0·274	0·303	0·283
7 12	0·505	0·129	0·135	0·410	0·138	0·008	0·296	0·206	0·156	0·339	0·504	0·493
8 12	0·379	0·128	0·144	0·601	0·739	0·372	0·630	0·450	0·491	0·296	0·440	0·735
9 12	0·439	0·193	0·221	0·807	1·251	0·698	1·051	0·676	0·399	0·304	0·608	0·837
10 12	0·514	0·564	0·249	0·614	1·447	0·850	1·303	0·675	0·518	0·331	0·512	0·857
11 12	0·493	0·407	0·034	0·825	1·693	1·184	1·357	0·850	0·446	0·418	0·566	0·766

128. The following are the approximate epochs of maxima and minima in *apparent* time as deduced from Table 57, distinguishing the epoch of the principal maximum by + and of the principal minimum by − ,

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Max.	22 20	+22 5	+22 5	+22 12	22 5	21 30	21 45	21 20	+21 55	+22 15	+22 40	+22 55
Min.	3 10	− 2 30	− 3 50	− 5 45	5 45	6 40	5 55	5 25	− 4 35	8 15	5 55	5 55
Max.	+14 0	12 45	14 0	14 30	...	...	...	...	14 35	12 25	10 30	11 15
Min.	−17 40	−18 40	17 50	17 0	...	...	...	...	17 5	−16 25	−18 15	−18 15

These epochs are very nearly the same as those obtained for the horizontal component No. 69. The diurnal variation of magnetic dip at Makerstoun has only one maximum and minimum in the four months May to August, and it has two maxima and two minima in the remaining eight months. The morning minimum near 6^h A.M., is the principal minimum in the four months October to January, in February the two minima are equal; in the other months the principal or only minimum, occurs near 6^h P.M.; the principal maximum of dip occurs in each month with the exception of January near 10^h A.M. It is only in the four winter months November to February that the 2^h A.M. maximum is well marked. The variations of the epochs of maxima and minima will be found with most accuracy from Table 58, which contains the diurnal variations for groups of months.

TABLE 58.—Diurnal Variations of Magnetic Dip for different periods, deduced from Table 57.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	′	′	′	′	′	′	′	′
12 12	+0·163	−0·346	−0·176	−0·424	−0·202	−0·019	−0·315	−0·168
13 12	+0·192	−0·031	−0·069	−0·186	−0·288	−0·048	−0·095	−0·072
14 12	+0·347	+0·331	+0·060	−0·042	−0·157	+0·095	+0·116	+0·105
15 12	+0·075	−0·042	+0·168	+0·032	−0·382	−0·153	+0·053	−0·051
16 12	−0·140	−0·048	+0·331	+0·179	−0·443	−0·291	+0·154	−0·069
17 12	−0·370	−0·158	+0·447	+0·454	−0·448	−0·409	+0·248	−0·081
18 12	−0·423	−0·184	+0·731	+0·664	−0·270	−0·346	+0·404	+0·029
19 12	−0·360	+0·180	+1·148	+1·190	+0·181	−0·089	+0·839	+0·375
20 12	−0·146	+0·928	+1·721	+1·856	+0·768	+0·311	+1·502	+0·906
21 12	+0·163	+1·463	+2·012	+2·261	+1·374	+0·768	+1·912	+1·340
22 12	+0·399	+1·679	+2·023	+2·210	+1·511	+0·955	+1·971	+1·463
23 12	+0·374	+1·485	+1·483	+1·589	+1·191	+0·782	+1·519	+1·151
0 12	+0·241	+0·916	+0·718	+0·833	+0·655	+0·448	+0·822	+0·635
1 12	−0·036	+0·183	−0·055	+0·036	+0·069	+0·016	+0·055	+0·035
2 12	−0·181	−0·289	−0·596	−0·541	−0·177	−0·179	−0·475	−0·328
3 12	−0·172	−0·632	−0·901	−1·089	−0·377	−0·274	−0·874	−0·574
4 12	−0·159	−0·799	−1·383	−1·270	−0·379	−0·269	−1·151	−0·710
5 12	−0·092	−0·913	−1·618	−1·603	−0·502	−0·297	−1·378	−0·838
6 12	−0·125	−0·837	−1·660	−1·597	−0·497	−0·311	−1·365	−0·838
7 12	−0·071	−0·711	−1·640	−1·409	−0·412	−0·241	−1·253	−0·748
8 12	−0·033	−0·611	−1·158	−1·120	−0·336	−0·184	−0·963	−0·574
9 12	+0·043	−0·469	−0·739	−0·797	−0·308	−0·132	−0·668	−0·401
10 12	+0·198	−0·552	−0·565	−0·671	−0·291	−0·046	−0·596	−0·321
11 12	+0·108	−0·554	−0·275	−0·557	−0·268	−0·080	−0·462	−0·271

129. The approximate epochs of maxima and minima in *apparent* time, from Table 58, are :—

	Dec. Jan. Feb.	March, April.	May, June,	July, Aug.	Sept. Oct. Nov.
Maximum,	+ 10h 20m A.M.	+ 10h 15m A.M.	9h 50m A.M.	9h 35m A.M.	+ 10h 0m A.M.
Minimum,	2h 50m P.M.	− 5h 0m P.M.	6h 20m P.M.	5h 30m P.M.	− 5h 35m P.M.
Maximum,	2h 5m A.M.	2h 10m A.M.	.....	.....	1h 55m A.M.
Minimum,	− 6h 5m A.M.	5h 45m A.M.	.....	.....	4h 55m A.M.

The principal maximum, near 10h A.M., occurs earliest in July and August, and latest in December to February : the afternoon minimum occurs earliest in the three winter months, and latest in May and June : the other maximum and minimum occur earliest in the months September to November. (See the Continuous Curves, Plate IV., where it is to be remembered that the apparent minima of the curves are the maxima of dip.) The following Table contains the diurnal variations for the days selected as nearly free from intermittent disturbance.

130. The approximate epochs of maxima and minima in *apparent* time for the undisturbed diurnal variations, are as follow :—

	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept Oct. Nov.
Maximum,	+ 10h 45m A.M.	+ 10h 20m A.M.	9h 50m A.M.	9h 45m A.M.	+ 10h 15m A.M.
Minimum,	5h 25m P.M.	− 7h 5m P.M.	6h 30m P.M.	7h 0m P.M.	− 6h 45m P.M.
Maximum,	1h 35m A.M.	3h 20m A.M.	.....	.....	1h 55m A.M.
Minimum,	− 6h 25m A.M.	5h 15m A.M.	.....	.....	5h 5m A.M.

In the undisturbed, as in the disturbed variations, the principal maximum occurs earliest in July and August, and latest in December to February ; but, unlike the disturbed variations, the afternoon minimum occurs latest near the equinoxes ; it occurs rather earlier at the winter than at the summer solstice. (See the Dotted Curves, Plate IV.)

TABLE 59.—Diurnal Variations of the Magnetic Dip for different Periods, deduced from Days selected as free from Irregular Disturbance in the Years 1844 and 1845.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	′	′	′	′	′	′	′	′
12 12	+0·084	−0·362	−0·319	−0·370	−0·280	−0·098	−0·350	−0·225
13 12	+0·151	−0·260	−0·168	−0·240	−0·221	−0·035	−0·223	−0·129
14 12	+0·136	−0·115	−0·037	−0·108	−0·217	−0·041	−0·086	−0·064
15 12	+0·033	−0·034	+0·106	−0·034	−0·257	−0·112	+0·012	−0·051
16 12	−0·081	−0·068	+0·190	+0·087	−0·316	−0·198	+0·069	−0·064
17 12	−0·229	−0·182	+0·388	+0·285	−0·350	−0·289	+0·163	−0·063
18 12	−0·265	−0·071	+0·658	+0·604	−0·202	−0·233	+0·396	+0·081
19 12	−0·270	+0·200	+1·002	+1·061	+0·132	−0·070	+0·754	+0·342
20 12	−0·095	+0·775	+1·492	+1·635	+0·777	+0·341	+1·300	+0·820
21 12	+0·113	+1·334	+1·810	+2·016	+1·287	+0·700	+1·719	+1·208
22 12	+0·370	+1·693	+1·839	+2·022	+1·495	+0·932	+1·851	+1·391
23 12	+0·425	+1·495	+1·403	+1·493	+1·138	+0·781	+1·463	+1·122
0 12	+0·258	+0·984	+0·749	+0·779	+0·715	+0·487	+0·837	+0·661
1 12	−0·010	+0·423	+0·063	+0·037	+0·158	+0·073	+0·174	+0·124
2 12	−0·094	−0·028	−0·296	−0·532	−0·073	−0·084	−0·286	−0·185
3 12	−0·052	−0·438	−0·715	−0·903	−0·205	−0·129	−0·686	−0·407
4 12	−0·082	−0·434	−0·953	−0·860	−0·332	−0·207	−0·750	−0·477
5 12	−0·194	−0·611	−1·298	−1·111	−0·401	−0·297	−1·008	−0·653
6 12	−0·184	−0·755	−1·385	−1·210	−0·551	−0·367	−1·117	−0·742
7 12	−0·084	−0·866	−1·355	−1·276	−0·546	−0·314	−1·166	−0·741
8 12	−0·024	−0·730	−1·096	−1·142	−0·491	−0·258	−0·990	−0·624
9 12	+0·065	−0·610	−0·889	−0·917	−0·474	−0·204	−0·806	−0·504
10 12	+0·037	−0·713	−0·676	−0·716	−0·429	−0·196	−0·702	−0·449
11 12	+0·003	−0·621	−0·522	−0·592	−0·364	−0·180	−0·579	−0·380

TABLE 60.—Differences of Disturbed and Undisturbed Diurnal Variations of Magnetic Dip, as deduced from Tables 58 and 59, exhibiting the Effect of Irregular Disturbance on the Hourly Mean Position.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	′	′	′	′	′	′	′	′
12 12	+0·079	+0·016	+0·143	−0·054	+0·078	+0·079	+0·035	+0·057
13 12	+0·041	+0·229	+0·099	+0·054	−0·067	−0·013	+0·128	+0·057
14 12	+0·211	+0·446	+0·097	+0·066	+0·060	+0·136	+0·202	+0·169
15 12	+0·042	−0·008	+0·062	+0·066	−0·125	−0·041	+0·041	0·000
16 12	−0·059	+0·020	+0·141	+0·092	−0·127	−0·093	+0·085	−0·005
17 12	−0·141	+0·024	+0·059	+0·169	−0·098	−0·120	+0·085	−0·018
18 12	−0·158	−0·113	+0·073	+0·060	−0·068	−0·113	+0·008	−0·052
19 12	−0·090	−0·020	+0·146	+0·129	+0·049	−0·019	+0·085	+0·033
20 12	−0·051	+0·153	+0·229	+0·221	−0·009	−0·030	+0·202	+0·086
21 12	+0·050	+0·129	+0·202	+0·245	+0·087	+0·068	+0·193	+0·132
22 12	+0·029	−0·014	+0·184	+0·188	+0·016	+0·023	+0·120	+0·072
23 12	−0·051	−0·010	+0·080	+0·096	+0·053	+0·001	+0·056	+0·029
0 12	−0·017	−0·068	−0·031	+0·054	−0·060	−0·039	−0·015	−0·026
1 12	−0·026	−0·240	−0·118	−0·001	−0·089	−0·057	−0·119	−0·089
2 12	−0·087	−0·261	−0·300	−0·009	−0·104	−0·095	−0·189	−0·143
3 12	−0·120	−0·194	−0·186	−0·186	−0·172	−0·145	−0·188	−0·167
4 12	−0·077	−0·365	−0·430	−0·410	−0·047	−0·062	−0·401	−0·233
5 12	+0·102	−0·302	−0·320	−0·492	−0·101	0·000	−0·370	−0·185
6 12	+0·059	−0·082	−0·275	−0·387	+0·054	+0·056	−0·248	−0·096
7 12	+0·013	+0·155	−0·285	−0·133	+0·134	+0·073	−0·087	−0·007
8 12	−0·009	+0·119	−0·062	+0·022	+0·155	+0·074	+0·027	+0·050
9 12	−0·022	+0·141	+0·150	+0·120	+0·166	+0·072	+0·138	+0·103
10 12	+0·161	+0·161	+0·111	+0·045	+0·138	+0·150	+0·106	+0·128
11 12	+0·105	+0·067	+0·247	+0·035	+0·096	+0·100	+0·117	+0·109

131. *Diurnal Variation of the Effect of Disturbance on the Magnetic Dip.*—A remark, similar to that made No. 72, with reference to the horizontal component, will apply to Table 60. The conclusions from this Table are as follow :—

1*st*, The greatest effect of disturbance in increasing the magnetic dip occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct Nov.
About	$12\frac{1}{2}^h$ A.M. $9\frac{1}{2}^h$ A.M.	$1\frac{1}{2}^h$ A.M. $8\frac{1}{2}^h$ A.M.	11^h P.M. and $8\frac{1}{2}^h$ A.M.	9^h A.M. 9^h P.M.	9^h P.M. 10^h P.M.

There are two epochs in May and June at which the positive effect of disturbance is a maximum, and there are two similar epochs for each group of months, for one of which either the positive effect is a secondary maximum, or the negative effect is a minimum ; the times of these are given above, in the second line.

2*d*, The greatest effect of disturbance in diminishing the magnetic dip occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	6^h A.M. and 3^h P.M.	4^h P.M. 6^h A.M.	4^h P.M. 4^h A.M.	5^h P.M. 12^h P.M.	$3\frac{1}{2}^h$ A.M. and 3^h PM.

In the winter groups there are two nearly equal maxima for the negative effect of disturbance, and in each of the others there is, besides the principal maximum, either a secondary maximum of the negative effect, or a minimum of the positive effect ; the times of these are given above in the second line.

3*d*, The effect of disturbance upon the hourly mean magnetic dip is zero

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	10^h A.M., 7^h P.M., 3^h A.M.	7^h A.M., 10^h A.M., 7^h P.M.	Noon, 9^h P.M.	1^h P.M., 8^h P.M.	10^h A.M., 6^h P.M., 1^h A.M.

The best defined hours are those from 6^h P.M. to 9^h P.M., and from 10^h A.M. to 1^h P.M.

See No. 76 for the probable law of mean disturbance for the magnetic dip, substituting for positive disturbance of the horizontal component, negative disturbance of dip, and *vice versa*.

TABLE 61.—Variations of the Magnetic Dip with reference to the Moon's Hour-Angle for the Winter and Summer Lunations, and for all the Lunations of the Years 1844 and 1845.

Moon's Hour-Angle.	Winter Lunations.			Summer Lunations.			All the Lunations.		
	1844.	1845.	Mean.	1844.	1845.	Mean.	1844.	1845.	Mean.
h. m.	′	′	′	′	′	′	′	′	′
0 0	+·012	+·021	+·017	−·012	−·045	−·028	·000	−·009	−·005
2 25	+·048	−·123	−·037	−·031	−·154	−·092	+·009	−·138	−·063
4 20	−·010	+·071	+·030	−·033	−·071	−·051	−·022	+·004	−·008
6 15	−·026	+·018	−·004	+·006	+·006	+·006	−·009	+·012	+·001
8 10	−·064	+·084	+·010	+·030	+·170	+·100	−·018	+·123	+·052
10 5	+·030	+·024	+·027	+·003	−·031	−·014	+·016	−·002	+·007
12 0	−·066	+·001	−·031	−·108	−·096	−·101	−·087	−·044	−·066
13 55	+·008	−·037	−·015	−·156	−·075	−·115	−·073	−·055	−·063
15 50	+·099	−·090	+·004	+·009	+·042	+·026	+·055	−·030	+·012
17 45	−·046	−·027	−·036	+·073	+·085	+·080	+·020	+·024	+·021
19 40	−·023	+·011	−·006	+·138	+·106	+·123	+·058	+·054	+·056
21 35	+·025	+·058	+·042	+·074	+·057	+·066	+·052	+·057	+·055

132. *Variations of the Magnetic Dip with Reference to the Moon's Hour-Angle.*—The four independent columns of Table 61, give results quite analogous to those obtained for the horizontal component of magnetic force, No. 79 : the results for the winter lunations of 1844, and for the summer lunations of both years, agree very nearly with that for the mean of both years in the last column of Table 61,—which may be stated as follows :—

The magnetic dip is a minimum about 1 hour after the moon's inferior transit.
…… maximum about $3\frac{1}{2}$ hours before the moon's superior transit.
…… minimum about $2\frac{1}{2}$ hours after the moon's superior transit.
…… maximum about 8 hours after the moon's superior transit.

The winter lunations for 1844 agree with this result, in having a minimum immediately after the inferior transit, but not otherwise: this difference, it is considered, is due to disturbances. (See No. 80.)

TOTAL MAGNETIC FORCE.

133. *Absolute Value of the Total Magnetic Force.*—The absolute value of the total magnetic force deduced from the value of the horizontal component, and the magnetic dip, as in No. 81, is as follows:—

Total magnetic force at Makerstoun for the mean epoch 1845 = 10·5267.

134. *Secular Change of the Total Magnetic Force.*—The determination of this depends chiefly on the balance magnetometer, and it is probable that the secular change from that instrument is not to be trusted (No. 84); indeed it is probable that the total force remains nearly constant, and this is the more likely the nearer the secular change deduced for the magnetic dip is considered to be to the truth. (See No. 116.)

135. *Effect of Disturbance on the Yearly Mean Value of the Total Magnetic Force.*—By Nos. 54 and 85, we find that the yearly mean deduced from the selected undisturbed days, is greater than that obtained from all the observations by 0·000045, the total force here and in the following discussions being considered equal to unity.

136. *Annual Period of the Total Magnetic Force.*—This result depends chiefly on that for the vertical component and is entitled to the same weight. The following are the variations of the monthly means of the total force, deduced from the observations of the balance and bifilar magnetometers for the four years 1843–6. (See Nos. 56 and 87.)

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·000	+099	−013	−074	−075	−034	+120	+052	−001	−049	−087	+011	+048

From these numbers, *the total magnetic force at Makerstoun is a maximum about the solstices, and a minimum immediately after the equinoxes* (See Plate VI.)

137. The monthly means deduced from all the hourly observations in 1844 and 1845, were greater (+) or less (−) than those obtained from the days selected as nearly free from disturbance by the following quantities. (See Nos. 57 and 89.)

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·000	−069	+001	−106	−060	−062	−003	−037	−061	−052	−078	−008	+002

The effect of disturbance on the monthly mean was nearly zero in the months of February, June, and December, and it was greatest in March and October. When these numbers are subtracted from those in No. 136 it is found that the annual period obtained from the undisturbed days in each month, has the same epochs as that obtained from all the days.

138. *Annual Variation of the Ranges of the Monthly Mean Diurnal Variation of the Total Magnetic Force.* The following are the ranges of the mean diurnal variation for each month, as obtained from Table 62, deduced from four years' observations.

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·000	319	291	612	821	701	546	663	738	715	521	443	298

The diurnal range of the total force was least in the three months, December, January, and February, and it was greatest in April and August: the ranges for March and September were greater than the range for June. The following are the ranges of the mean variations obtained from the selected days of 1844 and 1845.

Prefix.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
0·000	112	151	277	398	489	449	448	389	409	321	176	154

The range of the nearly undisturbed mean diurnal variation was least in January 1844–5, and it was greatest in May, but it is probable that the range is nearly constant while the sun is north of the equator, and that the differences exhibited here are due to the greater or less amount of disturbance remaining in the selected days. (See Nos. 92 and 93.)

139. *Variations of the Daily Mean Total Magnetic Force, with Reference to the Moon's Age.*—The fol-

lowing quantities, the means for groups of days from four years' observations, are obtained from the last column of the first parts of Tables 28 and 45. (Prefix 0·000.)

Moon's Age,	14^d—16^d	17^d—20^d	21^d—24^d	25^d—28^d	29^d—1^d	2^d—5^d	6^h—9^d	10^d—13^d
Variations,	— 024	+ 007	+ 024	+ 011	+ 001	+ 008	+ 009	— 034

The total force, therefore, is least near opposition, and it is greatest near the quadratures. (See No. 96, 1*st*.)

140. *Variations of the Daily Mean Total Magnetic Force, with Reference to the Moon's Declination.*—The following variations are derived from the final columns of Tables 28 and 45. (Prefix 0·000.)

Day after Moon farthest North.	27^d—1^d	2^d—5^d	6^d—8^d	9^d—12^d	13^d—15^d	16^d—19^d	20^d—22^d	23^d—26^d
Variations,	+ 024	— 004	—016	— 010	+ 017	— 004	— 001	—005

These variations indicate that the total force is a maximum when the moon is farthest north, and also when it is farthest south, and that is a minimum between these epochs. This result is quite analogous to that for the sun's position in declination (see No. 136). In both cases, the total force is greatest when the body (sun or moon) has its greatest north and south declinations, and it is least during the intermediate positions, or when the body is near the equator.

141. *Monthly Variations of the Range of the Total Force.*—This law is the same as that for the vertical component (No. 97), but has not been deduced for the total force, for the reason given No. 127. It may be stated generally, whether the position of the sun or the moon be under consideration, that the diurnal range of all the magnetic elements is greatest when the body is rather north of the equator, and that the range is least when the body is farthest south and farthest north. It has been found, generally, that when undisturbed mean variations are examined, the diminution of diurnal range, when the sun is most northerly, disappears, and it is probable that the same would be true with respect to the moon; the excess of range, when the bodies are near the equator, being due to the greater amounts of disturbance which occur at these times. (See No. 23.)

TABLE 62.—Diurnal Variations of the Total Magnetic Force for each Month, as deduced from the Regular Daily Observations made during the Four Years 1843 to 1846.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	0078	0036	0125	0000	0051	0201	0162	0049	0017	0078	0000	0021
13 13	0083	0014	0026	0072	0012	0151	0113	0026	0000	0053	0006	0028
14 13	0000	0000	0000	0021	0000	0138	0082	0000	0009	0024	0008	0003
15 13	0075	0006	0061	0122	0005	0161	0083	0041	0025	0033	0033	0000
16 13	0094	0030	0124	0113	0080	0170	0096	0107	0077	0000	0052	0029
17 13	0116	0055	0157	0189	0151	0170	0090	0132	0140	0033	0067	0046
18 13	0136	0073	0213	0249	0200	0181	0121	0163	0173	0089	0085	0063
19 13	0146	0091	0239	0266	0190	0178	0117	0162	0176	0154	0082	0061
20 13	0139	0085	0232	0233	0132	0134	0081	0118	0159	0150	0072	0060
21 13	0132	0056	0189	0186	0080	0062	0026	0088	0125	0133	0036	0036
22 13	0124	0046	0141	0154	0024	0014	0001	0072	0136	0115	0012	0014
23 13	0161	0061	0146	0155	0038	0000	0000	0081	0170	0143	0039	0035
0 13	0182	0100	0177	0216	0105	0068	0072	0151	0271	0234	0129	0064
1 13	0248	0147	0286	0310	0229	0150	0174	0303	0412	0332	0185	0112
2 13	0288	0208	0410	0447	0349	0251	0311	0420	0541	0411	0237	0167
3 13	0301	0272	0495	0574	0485	0347	0475	0559	0656	0521	0314	0234
4 13	0307	0287	0549	0658	0517	0453	0589	0652	0715	0517	0344	0245
5 13	0319	0291	0612	0800	0701	0513	0662	0738	0712	0498	0365	0255
6 13	0306	0288	0574	0821	0699	0546	0663	0738	0586	0460	0443	0298
7 13	0309	0264	0529	0718	0676	0535	0616	0659	0529	0407	0328	0261
8 13	0315	0218	0454	0563	0547	0479	0517	0532	0390	0344	0245	0165
9 13	0263	0177	0323	0421	0385	0396	0378	0334	0272	0278	0145	0136
10 13	0121	0123	0154	0352	0289	0305	0293	0262	0184	0216	0072	0105
11 13	0078	0040	0202	0247	0196	0227	0228	0099	0123	0131	0019	0067

142. *Diurnal Variation of the Total Magnetic Force.*—Table 62 has been computed from Tables 31 and 48. The following are the approximate epochs of maxima and minima in *apparent* time, distinguishing those of the principal maximum by +, and of the principal minimum by −.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Max.	+ 5 35	+ 5 0	+ 5 5	+ 5 55	+ 5 45	+ 6 30	+ 5 35	+ 5 35	+ 4 55	+ 3 40	+ 6 25	+ 6 20
Min.	−14 5	−14 0	−13 45	−13 0	−14 35	14 15	14 40	−14 5	−13 35	−16 15	−12 45	−14 45
Max.	19 5	19 15	19 30	19 0	18 40	18 35	18 30	18 35	18 50	19 45	18 50	19 5
Min.	22 0	21 55	22 30	22 45	−22 45	−23 0	−22 45	22 20	21 35	22 35	−22 50	−22 15

The principal maximum of the total magnetic force occurs between $3^h\ 40^m$ and $6^h\ 30^m$ P.M. in each month of the year; it occurs latest in June and November; it occurs earliest in February and March, of the first six months, and in October and September of the last six months of the year. The principal minimum occurs near 2^h A.M. in each month, with the exceptions of June and July, in which months it occurs near 11^h A.M.; in May, November, and December, the two minima are nearly equal. The secondary maximum occurs between $6\frac{1}{2}^h$ and $7\frac{3}{4}^h$ A.M., and it is best marked in the months of March, April, and May, August, and September.

TABLE 63.—Diurnal Variations of the Total Magnetic Force for Different Periods, deduced from Table 62.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months. Sept. to Feb.	Six Months. March to Aug.	Twelve Months.
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0091	−0236	−0123	−0154	−0180	−0135	−0171	−0154
13 13	−0094	−0249	−0168	−0190	−0192	−0143	−0202	−0173
14 13	−0135	−0288	−0180	−0218	−0198	−0166	−0229	−0198
15 13	−0109	−0207	−0166	−0197	−0182	−0145	−0190	−0168
16 13	−0085	−0180	−0124	−0158	−0169	−0127	−0154	−0141
17 13	−0064	−0125	−0089	−0148	−0132	−0098	−0121	−0110
18 13	−0045	−0067	−0059	−0117	−0096	−0070	−0081	−0076
19 13	−0037	−0046	−0065	−0120	−0075	−0056	−0077	−0067
20 13	−0041	−0066	−0116	−0160	−0085	−0063	−0114	−0089
21 13	−0061	−0111	−0178	−0202	−0114	−0087	−0164	−0126
22 13	−0075	−0151	−0230	−0223	−0124	−0099	−0201	−0151
23 13	−0050	−0148	−0230	−0219	−0095	−0072	−0199	−0136
0 13	−0021	−0102	−0163	−0148	−0001	−0011	−0138	−0074
1 13	+0033	0000	−0060	−0021	+0098	+0065	−0027	+0019
2 13	+0085	+0130	+0051	+0106	+0184	+0134	+0096	+0115
3 13	+0133	+0236	+0167	+0258	+0285	+0209	+0220	+0214
4 13	+0144	+0305	+0236	+0361	+0313	+0228	+0301	+0264
5 13	+0152	+0408	+0358	+0441	+0313	+0232	+0402	+0317
6 13	+0161	+0399	+0373	+0441	+0284	+0222	+0404	+0313
7 13	+0142	+0325	+0356	+0378	+0209	+0175	+0353	+0264
8 13	+0107	+0210	+0264	+0265	+0114	+0110	+0246	+0178
9 13	+0056	+0074	+0141	+0097	+0020	+0038	+0104	+0071
10 13	−0020	−0045	+0048	+0018	−0055	−0037	+0007	−0015
11 13	−0074	−0074	−0038	−0096	−0121	−0097	−0069	−0084

143. The means for groups of months having been obtained, as for the other magnetic elements, we find the approximate epochs for the mean diurnal variation in *apparent* time as follow:—

	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
Maximum,	$+6^h\ 10^m$ P.M.	$+5^h\ 25^m$ P.M.	$+5^h\ 45^m$ P.M.	$+5^h\ 35^m$ P.M.	$+4^h\ 50^m$ P.M.
Minimum,	$-2^h\ 10^m$ A.M.	$-2^h\ 10^m$ A.M.	$1^h\ 45^m$ A.M.	$-2^h\ 10^m$ A.M.	$-2^h\ 20^m$ A.M.
Maximum,	$7^h\ 10^m$ A.M.	$7^h\ 5^m$ A.M.	$6^h\ 35^m$ A.M.	$6^h\ 35^m$ A.M.	$7^h\ 35^m$ A.M.
Minimum,	$9^h\ 55^m$ A.M.	$10^h\ 35^m$ A.M.	$-10^h\ 45^m$ A.M.	$-10^h\ 35^m$ A.M.	$10^h\ 20^m$ A.M.

In the disturbed diurnal variation of total magnetic force, the principal maximum occurred latest in the quarter December to February, and earliest in the quarter September to November: the epoch of the after-midnight minimum varied little, being slightly nearer midnight in May and June than in the other groups; the secondary maximum occurred earliest in May and June, and latest in September to November; and the forenoon minimum occurred earliest in the quarter December to February, and latest in May and June. In May and June, therefore, the one minimum occurred nearest noon, the other nearest midnight. (See the Continuous Curves, Plate V.)

TABLE 64.—Diurnal Variations of the Total Magnetic Force for Different Periods, deduced from Days selected as free from Irregular Disturbances, in the Years 1844 and 1845.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0016	−0029	−0031	−0032	−0051	−0033	−0031	−0034
13 13	−0037	−0043	−0039	−0047	−0059	−0048	−0043	−0045
14 13	−0041	−0027	−0034	−0049	−0049	−0045	−0037	−0040
15 13	−0038	−0023	−0014	−0027	−0042	−0040	−0021	−0030
16 13	−0031	−0025	+0011	+0003	−0032	−0031	−0004	−0018
17 13	−0022	−0004	+0021	+0010	−0022	−0022	+0009	−0007
18 13	−0022	+0010	+0012	+0009	−0023	−0022	+0010	−0006
19 13	−0023	+0009	−0016	−0030	−0024	−0023	−0012	−0018
20 13	−0025	−0019	−0077	−0103	−0063	−0044	−0066	−0055
21 13	−0045	−0080	−0162	−0169	−0107	−0076	−0137	−0106
22 13	−0061	−0151	−0229	−0204	−0146	−0103	−0195	−0149
23 13	−0056	−0182	−0251	−0218	−0125	−0090	−0217	−0154
0 13	−0028	−0181	−0200	−0176	−0089	−0058	−0186	−0122
1 13	+0017	−0100	−0105	−0084	−0002	+0007	−0096	−0044
2 13	+0053	−0005	−0024	+0013	+0075	+0064	−0005	+0029
3 13	+0071	+0069	+0064	+0108	+0126	+0098	+0080	+0089
4 13	+0075	+0113	+0139	+0157	+0152	+0113	+0136	+0125
5 13	+0069	+0143	+0201	+0196	+0140	+0104	+0180	+0142
6 13	+0059	+0145	+0215	+0197	+0126	+0092	+0186	+0139
7 13	+0048	+0137	+0199	+0176	+0103	+0075	+0171	+0123
8 13	+0039	+0105	+0160	+0145	+0086	+0062	+0137	+0099
9 13	+0032	+0080	+0106	+0086	+0051	+0041	+0091	+0066
10 13	+0016	+0050	+0045	+0042	+0016	+0016	+0046	+0030
11 13	−0014	+0008	0000	−0004	−0036	−0025	+0001	−0012

144. When we consider the diurnal variation, as deduced from days selected as nearly free from intermittent disturbance, and as exhibited in Table 64, and in the dotted curves, Plate V., we find the approximate epochs in *apparent* time as follow:—

	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
Maximum,	+ 4h 0m P.M.	+ 5h 40m P.M.	+ 6h 0m P.M.	+ 5h 35m P.M.	+ 4h 15m P.M.
Minimum,	1h 40m A.M.	1h 10m A.M.	1h 30m A.M.	1h 40m A.M.	1h 25m A.M.
Maximum,	5h 35m A.M.	6h 45m A.M.	5h 15m A.M.	5h 35m A.M.	6h 20m A.M.
Minimum,	−10h 35m A.M.	−11h 45m A.M.	−10h 55m A.M.	−10h 55m A.M.	−10h 30m A.M.

The undisturbed diurnal variation of the total magnetic force differs considerably from that affected by disturbances, as may be seen at a glance in Plate V.; the whole variations of the epochs of maxima and minima, with season, are different from those obtained, No. 143. In each group of months, the forenoon minimum is the principal, and the after-midnight minimum is quite secondary. The principal maximum occurs earliest in winter, about 4h P.M., and latest in May and June, about 6h P.M.; the principal minimum occurs earliest in the six months, September to February, and latest in March and April: the secondary maximum occurs nearest noon, and the secondary minimum nearest midnight, in the equinoctial months.

TABLE 65.—Differences of Disturbed and Undisturbed Diurnal Variations of the Total Magnetic Force, as deduced from Tables 63 and 64, exhibiting the effect of Irregular Disturbance on the Hourly Mean Positions.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Six Months.		Twelve Months.
						Sept. to Feb.	March to Aug.	
h. m.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12 13	−0075	−0207	−0092	−0122	−0129	−0102	−0140	−0120
13 13	−0057	−0206	−0129	−0143	−0133	−0095	−0159	−0128
14 13	−0094	−0261	−0146	−0169	−0149	−0121	−0192	−0158
15 13	−0071	−0184	−0152	−0170	−0140	−0105	−0169	−0138
16 13	−0054	−0155	−0135	−0161	−0137	−0096	−0150	−0123
17 13	−0042	−0121	−0110	−0158	−0110	−0076	−0130	−0103
18 13	−0023	−0077	−0071	−0126	−0073	−0048	−0091	−0070
19 13	−0014	−0055	−0049	−0090	−0051	−0033	−0065	−0049
20 13	−0016	−0047	−0039	−0057	−0022	−0019	−0048	−0034
21 13	−0016	−0031	−0016	−0033	−0007	−0011	−0027	−0020
22 13	−0014	0000	−0001	−0019	+0022	+0004	−0006	−0002
23 13	+0006	+0034	+0021	−0001	+0030	+0018	+0018	+0018
0 13	+0007	+0079	+0037	+0028	+0088	+0047	+0048	+0048
1 13	+0016	+0100	+0045	+0063	+0100	+0058	+0069	+0063
2 13	+0032	+0135	+0075	+0093	+0109	+0070	+0101	+0086
3 13	+0062	+0167	+0103	+0150	+0159	+0111	+0140	+0125
4 13	+0069	+0192	+0097	+0204	+0161	+0115	+0165	+0139
5 13	+0083	+0265	+0157	+0245	+0173	+0128	+0222	+0175
6 13	+0102	+0254	+0158	+0244	+0158	+0130	+0218	+0174
7 13	+0094	+0188	+0157	+0202	+0106	+0100	+0182	+0141
8 13	+0068	+0105	+0104	+0120	+0028	+0048	+0109	+0079
9 13	+0024	−0006	+0035	+0011	−0031	−0003	+0013	+0005
10 13	−0036	−0095	+0003	−0024	−0071	−0053	−0039	−0045
11 13	−0060	−0082	−0038	−0092	−0085	−0072	−0070	−0072

145. *Diurnal Variation of the Effect of Disturbance on the Total Magnetic Force.* The remark made No. 102, for the vertical component, will apply also to the following conclusions obtained from Table 65.

1*st*, The greatest effect of disturbance in increasing the total magnetic force occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$6^h\ 30^m$ P.M.	$5^h\ 30^m$ P.M.	$6^h\ 15^m$ P.M.	$5^h\ 40^m$ P.M.	$5^h\ 10^m$ P.M.

The hours, it will be seen, agree very nearly with those found as the epochs of the maximum total force in the disturbed diurnal variation. The maximum positive effect of disturbance on the total force, occurs latest near the solstices and earliest near the equinoxes.

2*d*, The greatest effect of disturbance in diminishing the total magnetic force occurs

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$2^h\ 0^m$ A.M.	$2^h\ 15^m$ A.M.	$3^h\ 0^m$ A.M.	$2^h\ 45^m$ A.M.	$2^h\ 10^m$ A.M.

These hours are nearly the same as those for the after-midnight minimum of the diurnal variation; the difference is greatest in the summer months when the maximum negative effect occurs latest.

3*d*, The effect of disturbance on the total magnetic force is zero

In	Dec. Jan. Feb.	March, April.	May, June.	July, Aug.	Sept. Oct. Nov.
About	$10^h\ 45^m$ A.M.	$10^h\ 15^m$ A.M.	$10^h\ 10^m$ A.M.	$11^h\ 15^m$ A.M.	$9^h\ 45^m$ A.M.
	$9^h\ 40^m$ P.M.	$9^h\ 10^m$ P.M.	$10^h\ 15^m$ P.M.	$9^h\ 30^m$ P.M.	$8^h\ 45^m$ P.M.

The one of these epochs is nearly the same as that of the principal minimum in the undisturbed diurnal variation; the other occurs about twelve hours after.

TABLE 66.—Variations of the Total Magnetic Force with reference to the Moon's Hour-Angle for the Winter and Summer Lunations, and for all the Lunations of the Years 1844 and 1845.

Moon's Hour-Angle.	Winter Lunations.			Summer Lunations.			All the Lunations.		
	1844.	1845.	Mean.	1844.	1845.	Mean.	1844.	1845.	Mean.
h. m.	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000
0 0	−055	000	−028	+018	+011	+015	−019	+006	−007
2 25	−091	+025	−032	−006	+030	+012	−048	+028	−010
4 20	−068	−046	−057	−011	+020	+005	−040	−015	−027
6 15	−068	−031	−050	−023	+001	−011	−045	−015	−030
8 10	−052	−039	−045	−034	−036	−035	−043	−037	−040
10 5	−010	000	−005	−009	+002	−004	−010	+001	−004
12 0	+066	+030	+048	−007	+020	+006	+029	+025	+027
13 55	+106	+042	+073	+023	+027	+024	+065	+035	+050
15 50	+084	+045	+065	+038	−003	+017	+062	+023	+042
17 45	+054	+024	+039	+010	−028	−009	+031	000	+015
19 40	+045	−015	+015	−007	−039	−022	+019	−026	−004
21 35	−006	−031	−018	+008	−006	000	+001	−019	−008

146. *Variation of the Total Magnetic Force with Reference to the Moon's Hour-Angle.*—Of the four independent results in Table 66, that for the winter lunations of 1844 has the greatest range, and only one maximum and minimum, the maximum occurring about 2 hours after the moon's inferior transit, and the minimum about $2\frac{1}{2}$ hours after the superior transit: the three other results shew two maxima and two minima as follow:—

A maximum from 2 to 4 hours after the moon's inferior transit.
A minimum from 4 to $2\frac{1}{2}$ hours before the moon's superior transit.
A maximum from 0 to $2\frac{1}{2}$ hours after the moon's superior transit.
A minimum from 6 to 8 hours after the moon's superior transit.

In the mean of all, as shewn in the last column of Table 66, the first minimum and second maximum noted above, are scarcely visible, owing to the effect of the great range of the exceptional result for the winter lunations of 1844. The epochs from the means of all are—

The maximum of total force $2\frac{3}{4}$ hours after the moon's inferior transit.
A minimum ..... 2 hours before ..... superior transit.
A maximum ..... near ..... superior transit.
The minimum ..... 8 hours after ..... superior transit.

It is probable that the mean of all the lunations is vitiated by the winter lunations of 1844, and that the epochs given above for the remaining lunations of the two years are near the truth.

COMBINED MOTIONS OF THE MAGNETIC NEEDLE.

147. *Motions of the North End of a Magnetic Needle supposed freely suspended in the direction of the Magnetic Force.*—These motions have been represented in Plates VI.–VIII. by projecting the variations of dip, given in the previous Tables, as ordinates to the abscissæ deduced from the variations of declination for the same epochs multiplied by the cosine of the dip (=0·32). As great care has been bestowed on the determination and verification of the coefficients of reduction for the bifilar and balance magnetometers, upon which the element of dip depends, it is conceived that considerable confidence may be placed in the accuracy of these figures as representatives of the motions of the north end of a needle supposed freely suspended in the direction of dip at Makerstoun. No attempt has been made in these discussions to introduce theoretical views, but a consideration of the figures in the Plates will probably show the futility of many of the theories brought forth to explain the motion in declination.

148. *Annual Motions.*—The annual motion deduced from the observations of the three magnetometers for the four years 1843–6 is shown in figure A, Plate VI. In order to exhibit a more symmetrical form of the annual

motion, the magnetic dip, deduced from the observations of the bifilar magnetometer for the years 1842–5 and the balance magnetometer for the years 1843–6, has been employed to construct figure B ; the same declination being used as in figure A. For both figures the monthly mean values for the three magnetometers have been obtained from the curves (Plate VI.) passed freely through or among the projected points.

149. From near the vernal till the autumnal equinox the annual motion forms the half of an ellipse whose major axis, passing at the vertex through June, makes an angle of about $+11°$ in figure A and of $+16°$ in figure B with the projection of the magnetical meridian. At the autumnal equinox the north end of the needle again ascends till the winter solstice, after which it descends till the vernal equinox. In its descent, the north end of the needle having crossed its previously ascending path, it forms a loop which, when untwisted and continued downwards from the equinoxes, completes the ellipse ; the portion formed by the loop having almost exactly the same perimeter as that regularly formed when the sun is north of the equator ; the completed portion is indicated by dotted lines in figures A and B. It does not seem improbable that in southern latitudes the figure will be inverted, and that it will be a simple ellipse near the equator.

150. *Monthly Motions.*—The motion corresponding to the moon's varying phase has not been projected, chiefly because of the irregularities still existing in the result of the four years' observations for the magnetic declination, the epoch of minimum being ill-determined ; it is conceived that the figure is a simple ellipse with its major axis in the astronomical meridian, the northern extremity being at conjunction, the epoch of minimum dip, and the southern extremity at opposition, the epoch of maximum dip ; this, however, is doubtful.

151. The motion for the moon's position in declination has been obtained in the following manner :—Having first projected the means of magnetic declination for *each* three days of the moon's position in declination, as obtained from the Tables for the years 1843–6, the day after the farthest northerly position being the abscissa, a curve was passed freely among the points ; the values of the ordinates at the points of intersection by the curve were then taken as the interpolated values of magnetic declination for the corresponding abscissæ : a similar operation was performed for the magnetic dip. In both cases very satisfactory curves, agreeing nearly with the true points, were obtained. These values are projected in figure C, Plate VI. From this figure the north end of the dipping-needle commences its ascent about two days after the moon is north of the equator, attains its highest point about two days after the moon is farthest north, and afterwards it descends till the moon is again near the equator ; thus forming a figure like a portion of an ellipse with its vertex about one day after the moon is farthest north, the major axis making an angle of about $-30°$ with the magnetic meridian. It will be remarked that so far this motion is quite similar to that for the sun's position in declination, with the exception of the axis of the figure being on the opposite side of the magnetic meridian ; when we trace the figure farther the analogy still subsists ;—as the moon proceeds south of the equator the north end of the needle again ascends till the moon is farthest south, thereafter descending, and, in crossing its previously ascending path, a loop is formed lying partially out of the principal figure, as in the case of the annual motion.

152. The correspondence of the two results gives a great weight to the accuracy of both ; this will be more evident when it is remembered, that the whole motion of the dipping-needle for the moon's varying declination is included by a small circle with a diameter of little more than *one-tenth of a minute of space*, and, that no observation in the sixty thousand employed for this result has been rejected, however greatly affected by disturbance ; although the graphic interpolation to remove slight irregularities may be considered an equivalent operation.

153. *Diurnal Motions.*—The monthly mean diurnal variations for the magnetic declination and magnetic dip in Tables 12 and 57, still present irregularities, especially from 10^h P.M. till 4^h A.M., the hourly positions for this time depending on only two years' observations. For this reason, the values from these Tables having been projected, curves were passed freely among the points, and the interpolated ordinates thus formed, were taken for the projections in Plate VII. : the interpolated quantities differ very little from the actual values, and this is especially the case for the summer months.

154. The diurnal motions for the 4 winter months November to February, are of the same class, and they differ considerably from those for the other months (see Plate VII.) ; in each of these months the motion consists of a figure of two closed loops : the north end of the needle moves eastwards with little change of dip from about 1^h P.M. till 9^h or 10^h P.M., after which it turns westwards, and begins to ascend about 4^h A.M., crossing near its position at 6^h P.M., thus forming an eastern loop, which is small compared with the western loop, excepting in December. After 6^h A.M., the north end of the needle having moved a little westwards, again descends, crossing a second time the afternoon track near 5^h P.M., still moving westwards, it ascends about 11^h A.M. till it meets the position of 1^h P.M., thus completing the western loop. The eastern loop is not formed in March, the north end of the needle not rising sufficiently high to cross the afternoon track. The change in the figure from February to March is very great ; in April and May the remains of the eastern loop are still visible, but in June and July its position is indicated by a simple inflection in the figure ; in August and September the germ of the eastern loop becomes more distinct, and in October the loop is actually formed. The transition in form from autumn to winter is quite gradual, unlike that from winter to

spring. In the winter months, the principal or western loop is formed by the motion from 8^h A.M. till 5^h P.M.; in the months from April to August, three-fourths of the whole diurnal motion occur between 6^h A.M. and 6^h P.M., the remaining fourth forming a slightly inflected side to each of the figures: it is this side which is gradually twisted up to form the eastern loop of the winter months. The figures for means of groups of months, as in Tables 13 and 58, have been projected in Plate VIII. on a larger scale, the diurnal motions from the days selected as nearly free from irregular disturbance have been projected with dotted outlines along with the others. In these figures the actual values in Tables 13, 14, 58, 59 have been employed. In the winter months the undisturbed diurnal variation presents a series of convolutions instead of the eastern loop, and in the other months the general form of the figures is not much altered.

155. It is evident that no proper comparison can be made of the areas of these figures, on account of the involved forms in the winter months; the areas, however, of the figures from April to August, differ very little.*

156. *Perimeters of the Figures.*—The twisting of the perimeters, which renders a comparison of the areas of little value, does not appear to affect the length of the motion, and this therefore seems a fair subject for examination. The following are the values of the angular motion, or length of the perimeter, for each month, as obtained approximately from Plate VII.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5′·60	6′·16	9′·22	12′·18	12′·04	12′·00	11′·56	11′·64	10′·48	9′·78	7′·22	5′·84

December and January shew the least perimeters, April, May, and June, the greatest, though the perimeters for the months from April to August are nearly constant.

157. The following are the approximate perimeters of the five independent figures of Plate VIII.:—

	Dec.–Feb.	March, April.	May, June.	July, Aug.	Sept.–Nov.
Mean of all,	6′·19	11′.58	11′·88	11′·92	9′·04
Mean of undisturbed days,	4′·34	9′·86	10′·68	11′·28	7′·76

158. *Hourly Angular Motions.*—Having obtained the approximate motion from hour to hour for each of the monthly figures of Plate VII., we find that, on the whole, they follow nearly the same law, that indicated in the following numbers, which are the means of the motions from the 12 separate months, and from other groups of months.

TABLE 67.—Mean Angular Motions, from Hour to Hour, of the north end of a Needle supposed freely suspended in the direction of the Magnetic Force, as obtained (1.), from the Monthly Figures of Plate VII. (2.), from the 5 Independent Continuous Figures of Plate VIII.; and (3.), from the 5 Independent Dotted Figures of Plate VIII.

Time.	Means from 12 Figures.	Means from 5 Continuous Figures.	Means from 5 Dotted Figures.	Time.	Means from 12 Figures.	Means from 5 Continuous Figures.	Means from 5 Dotted Figures.
h. h.				h. h.			
12—13	0′·19	0′·10	0′·20	0— 1	0′·64	0′·59	0′·62
13—14	·23	·10	·20	1— 2	·49	·48	·50
14—15	·25	·14	·16	2— 3	·59	·53	·60
15—16	·22	·18	·25	3— 4	·51	·51	·53
16—17	·24	·24	·23	4— 5	·48	·34	·48
17—18	·25	·23	·24	5— 6	·40	·19	·35
18—19	·37	·28	·38	6— 7	·20	·14	·28
19—20	·58	·53	·55	7— 8	·36	·19	·30
20—21	·61	·58	·63	8— 9	·21	·17	·22
21—22	·69	·76	·69	9—10	·15	·13	·13
22—23	·91	·85	·88	10—11	·14	·17	·14
23— 0	·70	·67	·73	11—12	·24	·22	·16

* It may not be unimportant to remark here, that the processes usually adopted in order to determine the epochs of maxima and minima for the separate elements of declination and dip, are not strictly accurate; and that is the case whether the process be one of interpolation from graphic projection, where the time is the abscissa, or one of computation, where the variable is a function of the hour angle. This is evident, when we examine the figures in Plates VII. and VIII., where the dip and declination are the co-ordinates. The error, however, will not affect any of the comparative conclusions for these elements in the previous pages. A similar exception may be taken to the accuracy of comparisons of areas of declination curves, where time is the abscissa.

159. These numbers give the following curious result;—That the velocity of motion of the north end of a magnet freely suspended in the direction of the magnetic force is a maximum when the sun makes its superior transit of the magnetic meridian (between 10^h and 11^h A.M.), and a minimum when it makes its inferior transit of the same meridian (between 10^h and 11^h P.M.). This result is the more curious that the epoch of the minimum velocity of the diurnal motion is an epoch of maximum disturbance, and, in as far as the declination is concerned, the epoch of maximum velocity of the diurnal motion is also an epoch of minimum disturbance.

160. When we compare the results for the irregular disturbance, with reference to the separate elements of magnetic declination and magnetic dip (see horizontal component), with the velocities of motion as deduced from these figures, we find, that *when the diurnal motion is most rapid the departures from the direction of that motion are least*, and *when the diurnal motion is slowest the irregular departures from the hourly mean position are greatest*.

161. It is scarcely possible to connect the previous facts of area, perimeter, or velocity of motion with the laws of variation of temperature. In the mean for the whole year, the temperature changes most rapidly between 8^h and 9^h A.M.; but it changes with nearly equal rapidity between 5^h and 6^h P.M. There is no corresponding fact in the previous numbers. When we compare the variations of temperature with the variations of position for the suspended magnet in the summer months, we find the difference between the two classes of facts even more marked: in summer, the temperature changes most rapidly about 7^h A.M. and 7^h P.M., the change for May, June, and July, from 6^h–8^h A.M. being $+3°{\cdot}80$, and from 6^h–8^h P.M. being $-3°{\cdot}54$; for the same months the mean angular motion of the needle from 6^h–8^h A.M. $=1'{\cdot}00$, from 9^h–11^h A.M. $=2'{\cdot}12$, and from 6^h–8^h P.M. $=0'{\cdot}74$. There is a diminution in the velocity of the motion between 1^h and 2^h P.M.; there is also a slight diminution at the turning point, 6^h–7^h P.M. and between 2^h and 3^h A.M. These diminutions appear to be connected with the fact, that they occur at turning points in the figures.

162. It may be remarked that the line representing the astronomical meridian, and passing through the centre of gravity of the figures for the months during which the sun is north of the equator, also passes through the position of greatest velocity, and nearly through that of least velocity, of the diurnal motion.

163. *General Form and Turning Points of the Diurnal Motions.*—The general forms of the diurnal motion vary between rude ellipses and circles. In the winter months, the principal portion, or loop of the figures, is elliptical with the major axis horizontal; near the equinoxes the figure becomes somewhat circular, and in the midsummer months it again becomes rudely elliptical, with the major axis inclined about 20° or 30° west of the magnetic meridian. In the usual investigations of the conventional element of declination, it has been remarked that the turning from the farthest westerly position occurs near the time of maximum temperature; a coincidence which has been supposed to indicate a real connection, though there is no similar coincidence between the epoch of minimum temperature and the eastern turning point. If, however, we examine the figures indicating the diurnal motions of a needle in its *true* position, such as those for the months of April, August, October, &c., we might find it difficult to say, where is a turning point and where not; and it is difficult to see why the turning points at the extremities of the horizontal diameters of these rude circles, or at the extremities of *a* horizontal line, in the ruder ellipses, should be chosen, in preference to the turning points at the extremities of other lines drawn in the figures, as tests for a theory; unless, indeed, it be explained by the accident that a horizontal suspension of a magnetic needle is a convenient one for observing a certain portion of the motion of a magnet, which, independently of gravity, would rest in the direction of the magnetic force.

164. It may be noticed, chiefly with reference to the months from March to October, that a line passing through the positions of noon and midnight also passes through, or nearly through, the mean position, or the centre of gravity, each hour having equal weight: also a line passing through the positions about four hours before and four hours after noon, passes nearly through the centre of gravity of the figures; the former of these lines lies nearly in the direction of the minor axis, the latter nearly in that of the major axis of the rude ellipses for the midsummer months. The horizontal line passing through the centre of gravity, also passes nearly through the positions of 1^h A.M. and 1^h P.M., which, therefore, are the epochs of mean dip. (See also No. 162.)

165. *Angular Distances between the Hourly Positions from the Mean of all, and from the Undisturbed Days.*—It has been already stated, in considering the *effect* of disturbance on the hourly mean values of the magnetic elements, that it is assumed that the mean of all the hourly values is unaffected, which, in the present case, is equivalent to assuming, as has been done in Plate VIII., that the centre of gravity of the disturbed and undisturbed figures is the same; this must be very nearly true, as regards its position in declination (No. 38), but it is probable that there is some error with reference to its position in dip: it will be seen from No. 123, that this error in the figures for May–June and July–August is very small; it will also be seen from No. 123, that the dotted figures for the other months should be raised somewhat in the page, since the centre of gravity of the dotted figure has a less dip than that of the continuous figure; the effect of this elevation would be chiefly to diminish the distance between the points about 4^h and 5^h P.M. on the figures for March and April:

these remarks may be kept in view, in considering the numbers in the following Table, which are obtained from Plate VIII.

TABLE 68.—Angular Distances between the Disturbed and Undisturbed Positions for each Hour in the motion of a freely-suspended Dipping-Needle, as obtained from Plate VIII.

Mak. Mean Time.	Dec. Jan. Feb.	March. April.	May. June.	July. Aug.	Sept. Oct. Nov.	Sept. to Feb.	March to Aug.	Year. From Mean Curve.	Year. Mean of first 5 Columns.
h.	′	′	′	′	′	′	′	′	′
12	0·36	0·20	0·34	0·28	0·36	0·35	0·25	0·32	0·32
13	·26	·32	·26	·24	·28	·28	·31	·26	·27
14	·28	·46	·20	·18	·14	·18	·28	·24	·24
15	·09	·16	·16	·06	·12	·08	·12	·08	·12
16	·06	·04	·18	·08	·12	·09	·09	·04	·09
17	·15	·08	·08	·24	·14	·13	·14	·08	·14
18	·21	·20	·08	·32	·34	·25	·18	·22	·24
19	·20	·24	·14	·32	·40	·29	·22	·26	·27
20	·18	·30	·30	·46	·42	·29	·34	·28	·33
21	·22	·36	·28	·30	·40	·30	·32	·32	·31
22	·24	·28	·26	·20	·26	·28	·22	·28	·25
23	·24	·30	·16	·36	·26	·24	·18	·24	·26
0	·28	·28	·12	·14	·30	·26	·18	·22	·23
1	·35	·24	·28	·16	·24	·28	·24	·28	·26
2	·36	·36	·40	·16	·38	·34	·30	·34	·34
3	·29	·32	·26	·24	·36	·30	·28	·28	·30
4	·28	·44	·46	·44	·16	·40	·44	·32	·33
5	·12	·30	·34	·50	·12	·04	·35	·18	·26
6	·15	·36	·30	·42	·32	·19	·28	·16	·30
7	·18	·42	·30	·26	·38	·27	·22	·24	·30
8	·43	·36	·16	·24	·58	·50	·24	·38	·38
9	·38	·38	·24	·44	·44	·38	·34	·38	·38
10	·39	·38	·30	·36	·52	·45	·34	·40	·40
11	·42	·26	·38	·22	·50	·45	·32	·38	·37

166. The following are the conclusions from Table 68 :—

1*st*, In the two figures for the months from September to February, the effect of disturbance in displacing the needle is a *minimum* about 4^h A.M. and 4^h P.M., the values for these hours being nearly equal, or *near the hours when the sun is on the magnetic prime vertical.* The maximum effect of disturbance occurs in both about 10^h P.M., when the sun is on the magnetic meridian, a secondary maximum occurring in the figure December to February about $1\frac{1}{2}^h$ P.M., and in the figure September to November about 8^h A.M.

2*d*, In the figure for March–April, the minimum occurs about 4^h A.M., and the maximum probably about 8^h–10^h P.M., the value, however, varying little for the 18 hours from 8^h A.M. till 2^h A.M.

3*d*, The mean of the two results for the figures May–June and July–August is to some extent the reverse of the result for December to February. The effect of disturbance is a minimum about 4^h A.M., and about noon ; it is a maximum about 8^h A.M. and 4^h P.M. It would appear, therefore, that the diurnal law of the *effect* of disturbance varies with season as well as the law of the amount of disturbance (see Nos. 45, 77, 110) : a minimum is also shewn about 8^h P.M.

4*th*, In all months of the year the effect of disturbance is a minimum about 4^h A.M. In the winter months a minimum occurs at 4^h P.M., the maximum occurs at the same hour in the summer months.

5*th*, In the mean figure for the year, minima occur at 4^h A.M. and about $5\frac{1}{2}^h$ P.M., the maximum occurs about 10^h P.M., and a maximum occurs between 8^h A.M. and 4^h P.M. If, making allowance for the effect of disturbance on the position of the centre of gravity with reference to dip (No. 121), we suppose the centre of gravity of the dotted figure for the year (Plate VIII.) raised 0′·15 on the line of mean declination, or that of the continuous figures lowered as much, we find the maximum effect of disturbance to occur about 10^h P.M. and 10^h A.M., and the minimum effect about 4^h A.M. and 5^h P.M. This result was obtained for the magnetic declination in 1844. See the Volume for that year, p. 345.

167. *Motions with reference to the Moon's Hour-Angle.*—These, as obtained from the means of all the lunations in the years 1844 and 1845, and as deduced from winter lunations for 1845 only, are shewn in Plate VII. The resulting figures, especially that for the winter lunations of 1845, bear some resemblance to the diurnal motion for the month of December.

THE AURORA BOREALIS.

168. The results for the aurora borealis are placed between the magnetical and meteorological discussions, because the appearances of this meteor are distinctly connected with magnetic disturbances; the frequency of the one and the magnitude of the other, it will be seen, are governed by the same laws.

169. The following Table contains a list of all the auroræ seen at Makerstoun, between January 1843 and June 1849. A very careful outlook for auroræ was kept throughout the whole period, but especially during the first five years; an outlook warned by magnetic disturbance in circumstances unfavourable to the visibility of the meteor, and assisted by a practical acquaintance with the faintest auroral indications. In several cases, the auroral appearances were very faint; these are entered in the Table as "Traces," and, in others, there was doubt whether the appearance was truly auroral; these are indicated by "Trace?" It should be noted that, with the exception of the years 1844 and 1845, auroræ were seldom looked for after midnight.

TABLE 69.—List of Auroræ Boreales seen at Makerstoun in the years 1843–9.

Date, Göttingen Mean Time.	Moon's Age.	Sky Clouded.	Species of Clouds.	Character of Magnetic Disturbance.	General Remarks.	Page of Reference.
1843. d. h.—h.	d.					(1843.)
Jan. 28 8	28	0·0		Slight	Traces. (Seen at Christiania.)	93
Feb. 24 10—13	25	9·7	Scud	Moderate	Traces. (Seen at Christiania and in United States.)	201
Mar. 6 14	5	2·0	Cum.-scud	Moderate	Seen through clouds.	203
7 8	6	0·0		Moderate	Arch 10° altitude.	54
12 9—13	11	2·0	Scud	Considerable	Distinct.	54
29 9—12	28	0·0		Moderate	Segment of circle 15° alt. $10\frac{1}{2}^h$, equatorial beam.	111, 61
Apr. 5 9—14	6	0·0		Considerable	Bright arches and streamers.	61
6 14—16	7	0·0		Considerable	14^h; arch 10° broad, 15° altitude. Corruscations.	205
Sept. 18 10—12	24	2·5	Cirro-str.	Moderate	Bright. $14^h\ 35^m$; 12° altitude.	213
19 10	25	9·8	Cirrous	Moderate	11^h; band 10° altitude; seen through clouds.	69
20 14—15	26	1·0	Scud		Traces. (Seen at Christiania.)	69
Oct. 15 10	21				Auroral arch 15° altitude. Streamers.	173
16 10	22	9·8	Cirrous	Slight	Traces through clouds.	175
26 8—10	3	0·5	Loose cum.	Moderate	$9^h\ 50^m$; arch 8° altitude.	177
Nov. 2 10	10	0·2		Slight	Traces.	70
13 8—10	21	9·8	Various	Slight	Distinct. [places.	183
14 10	22	8·0	Cir.-strati	Slight	Traces. 12^h; magnets slightly disturbed at other	183
Dec. 11 10	19	5·0	Sc.; cir.-str.	Moderate	Distinct.	71
12 8	20	10·0	Scud	Moderate	Traces; through clouds. (Appearances at Parma.)	191
27 6	6	0·8	Scud	Slight	Traces.	72
1844.						(1844.)
Jan. 5 10	15	9·0	Scud	Moderate	Traces.	174
10 10—11	20	2·0	Cirri	Moderate	Traces.	175
Feb. 7 9	19	0·5	Loose scud	Moderate	Faint.	186
11 13—14	23	5·5	Cirri	Slight	Traces. (Suspected at New Haven, Connecticut.)	187
22 8	4	5·0	Cirri	Slight	Traces.	158
Mar. 2 9	13	1·0	Scud; cir.	Moderate	Trace. (Bright moonlight.)	158
7 8—10	18	1·0	Cir.-str.	Moderate	Rather bright. Arch and streamers.	158
9 13	20	2·0	Sc.; cirri	Moderate	Rather bright.	158
12 11	23	0·1	Cirri	Slight	Faint.	158
29 11—16	12	0·1	Cirri	Moderate	Bright. Arches and streamers.	158
Apr. 5 12—14	19	0·2	Cir.-str.	Moderate	Streamers, arch and band.	158
10 13	23	0·9	Cir.-str.	Slight	Traces.	209
17 11—12	0	5·0	Cirri	Considerable	Faint streamers and homogeneous light.	158
May 8 11—12	21	1·2	Cirri	Moderate	Faint.	158

TABLE 69.—*continued.*

Date, Göttingen Mean Time.	Moon's Age.	Sky Clouded.	Species of Clouds.	Character of Magnetic Disturbance.	General Remarks.	Page of Reference.
1844.						(1844.)
d. h.–h.	d.					
May 21 12	4	2·0	Cirri	Slight	Traces.	158
22 11	5	0·2	Haze	Moderate	Trace. (Seen at New Haven.)	158
Aug. 2 14	18	0·5	Cirri	Moderate	Faint. [tucket, Mas.)	252
9 14	25	3·0	Scud	Moderate	Traces. (Seen at Whitehaven, and at Nan-	158
Oct. 2 8—10	20	1·0	Cirri	Moderate	Belt of light 5° altitude.	158
5 10—11	23	0·0		Slight	Faint.	158
7 11—12	25	0·5	Cirri	Slight	Faint.	277
20 14—18	10	0·5	Cir.-str.	Considerable	Bright. Arches and streamers.	159
Nov. 11 6—14	1	0·5	Cir.-str.	Moderate	Distinct. Arch and streamers.	159
12 14	2	10·0	Scud	Moderate	Traces through clouds.	159
13 10	3	8·0	Scud	Slight	Trace. (Seen at Christiania.)	159
16 10—11	6	7·0	Cirri	Large	Arch 5°–8° altitude. Patches and streamers.	159
18 9	8	10·0	Scud	Moderate	Faint.	159
24 13	14	1·0	Cirri		Portion of an arch 10° altitude.	159
Dec. 4 8	24	0·2	Cir.-str.	Moderate	Faint.	160
29 6—14	20		Cirri	Large	Brilliant. Arches, patches, and streamers.	160
1845.						(1845.)
Jan. 0 15—16	22	5·0	Cir.-cum.	Slight	Faint.	118
9 7—14	1	0·5	Cirri	Large	Bright. Arches, brushes, and streamers.	118
19 12	11	9·0	Cir.-cum.	Moderate	Traces.	119
20 11	12	2·5	Cir.-cum.	Slight	Traces. (Seen in Orkney.)	119
21 8	13	9·5	Scud	Moderate	Traces.	119
23 15	15	10·0	Cir.-str.	Moderate	Seen through a break in the clouds.	119
24 13	16	0·5	Cirri	Moderate	Traces.	119
26 13—15	18	4·0	Cirri	Moderate	Auroral appearances between the clouds.	120
28 8—12	20	6·0	Cir.-str.	Moderate	Distinct.	120, 146
29 7— 9	21	1·5	Cir.-str.	Moderate	Faint.	120
30 8—10	22	0·5	Haze	Moderate	Traces.	120, 147
Feb. 1 12—13	24	0·8	Cirri	Slight	Milky aurora.	120
5 8—13	28	2·0	Cirrous	Moderate	Arch and streamers.	121
7 14—15	1	2·5	Cirrous	Slight	Milky aurora.	121
24 8—13	18	0·0		Moderate	Arch 8° altitude, and streamers.	122
26 15	20	3·0	Cir.-cum.	Moderate	Trace?	157
28 12—14	22	4·5	Cirri	Moderate	Faint; milky aurora.	122
Mar. 9 16	1	10·0	Scud	Moderate	Seen through clouds.	161
14 11	6	4·0	Scud	Moderate	Traces?	163
18 10	10	2·0	Cir.-cum.	Slight	Faint.	123
19 10—13	11	0·5	Cir.-str.	Slight	Faint.	123
20 14—15	12	0·5	Cirri	Moderate	Faint.	165
23 13—14	15	5·0	Cirri	Moderate	Faint.	123
24 15	16	4·0	Cirri	Considerable	Traces.	123
25 9	17	9·8	Cir.-str.	Moderate	Trace?	167
26 11—14	18	4·0	Scud	Moderate	Traces.	123
28 10—11	20	0·8	Cir.-str.	Moderate	Faint.	168
29 11—12	21	0·8	Cirri	Slight	Faint.	123
Apr. 13 11—16	7	7·0	Cir.-str.	Considerable	Brilliant. Arches and streamers.	123
15 11	9	8·0	Cir.-cum.	Slight	Trace?	175
19 11	13	4·5	Scud	Moderate	Trace.	123
30 11—14	24	7·0	Scud	Moderate	Faint.	123
May 11 13—14	5	1·5	Cir.-str.	Slight	Faint.	184
Aug. 29 10—13	26	0·3	Cir.-str.	Moderate	Distinct. Belts and streamers.	123
30 12	27	1·0	Cirri	Slight	Faint. Seen through clouds.	226
Sept. 2 10—12	1	0·2	Cir.-str.	Moderate	Distinct. Streamers.	124
25 16	24	0·8	Cir.-cum.	Moderate	Faint.	236
27 9—10	25	5·0	Scud	Moderate	Faint. 9^h arch 7° altitude. 10^h; streamers.	237

TABLE 69.—*continued.*

Date, Göttingen Mean Time.	Moon's Age.	Sky Clouded.	Species of Clouds.	Character of Magnetic Disturbance.	General Remarks.	Page of Reference.
1845. d. h.—h.	d.					(1845.)
Oct. 1 16	0	6·0	Scud	Slight	Trace. (Seen at Christiania.)	238
20 13	19	0·0		Moderate	Faint. Patches and streamers.	124
21 15—17	20	2·0	Cirrous	Moderate	Faint.	245
31 11—12	0	5·0	Cirrous	Slight	Traces. (Seen at Christiania.)	249
Nov. 4 11—12	5	0·0		Slight	Faint. Diffuse light, with streamers.	124
5 7	5	0·5	Cirri	Moderate	Arch 12° altitude.	124
17 7—11	17	0·5	Cirri	Moderate	Bright. Arches, streamers, and brushes.	124
Dec. 3 6—18	4	0·0		Very large	Brilliant. Arches, streamers, and brushes.	125, 261
13 10	14	0·0		Moderate	Trace.	265
1846.						(1846.)
Feb. 25 9—12	0	0·5	Sc.; cir.str.	Moderate	Arch and short streamers.	342
26 10—11	1	8·5	Scud	Moderate	Diffuse light and faint streamers.	342
Mar. 16 9—12	19	9·8	Scud	Considerable	Faint light, arch, and streamers.	342
Apr. 6 11—13	10		Cir.-str.	Moderate	Faint.	342
16 10—11	20	1·0	Scud	Considerable	Faint.	342
Aug. 24 11—12	3	0·0		Moderate	Diffuse light, with faint streamers.	342
27 10—12	6	8·0	Scud	Considerable	Distinct. Patches and streamers.	342
Sept. 10 9—10	19	5·0	Cirri	Moderate	Faint. Arch 7° altitude.	342
11 10—11	20	3·0	Cir.-str.	Considerable	Faint. Beam. [bank 5° alt.	342
21 13—16	1	8·0	Scud	Considerable	Distinct. Incessant pulsations of patches. 15^h;	343
22 10	2	8·0	Cir.-str.	Very large	Evidently bright, but obscured by clouds.	395
Oct. 8 8— 9	18	6·0	Cir.-str.	Considerable	Aurora. Faint streamers.	343
9 8	19	2·5	Sc.; cir.-str.	Moderate	Bright streamers.	343
19 10	29	3·0	Sc.; cir.-str.	Slight	Faint.	399
22 10	2	9·8	Cir.-str.	Moderate	Traces; through clouds.	343
Nov. 17 7— 8	28	4·0	Sc.; cir.-str.	Large	Bright. Arches and streamers.	343
Dec. 9 9—10	21	0·5		Moderate	Arch.	343
1847.					N.B.—*See additional Notes after Table 69.*	
Jan. 30 9	13			Moderate	Faint. [like clouds from NW.	
Feb. 6 8—10	20		Cirrous	Slight	Faint light. Arch and streamers; cirrous-fan-	
Mar. 19 8—12	3		Cirrous	Very large	Bright. Corona borealis. $8^h\ 50^m$; arch about 10° alt. from NNW. $9^h\ 20^m$; arch about 20° alt. from SSE.	
Apr. 3 10—11	17		Cir.-cum.	Considerable	Pulsations seen to 20° altitude above clouds.	
Aug. 22 14	12			Slight	Faint. Varying patches.	
Sept. 26 7—11	17				Beautiful. Streamers, arches, brushes, waves, &c.	
29 8—12	20		Cir.-str.	Large	Pulsating patches, diffuse light, arches, stream-	
Oct. 8 8	29		Sc.; cir.-str.		Traces. [ers, &c.	
16 8	7	0·0		Moderate	Faint, with streamers.	
19 11	10		Scud	Slight	Low band. Streamers close to horizon.	
24 14	15		Cir.-str.	Excessive	$11^h\ 7^m$; Splendid corona, &c.	
29 7—11	20		Scud	Moderate	Faint. 8^h; arch 8° alt. 11^h; streamers on horizon.	
Nov. 1 7	23		Scud	Slight	Traces.	
19 9—11	11		Scud	Large	Fine red-coloured patches and streamers. $10^h 12^m$; corona borealis centre 71° alt., azimuth S. 25° E.	
25 10	17		Sc.; cir.-str.	Moderate	Faint.	
26 10	18		Cir.-str.	Slight	Faint.	
27 10—11	19		Stratus	Moderate	Distinct.	
Dec. 20 8	13		Scud	Excessive	Splendid crimson aurora, with corona borealis, &c.	
1848.						
Feb. 20 10—12	15				Brilliant. Coloured; streamers and corona bor.	
21 9—10	16				Id. Much concealed by clouds.	
22 7—10	17				Id. $8^h\ 50^m$; arch passing through zenith. $8^h\ 55^m$; lower edge of arch 42° above SSE.	

TABLE 69.—*continued.*

Date, Göttingen Mean Time.	Moon's Age.	Sky Clouded.	Species of Clouds.	Character of Magnetic Disturbance.	General Remarks.	Page of Reference.
1848.						
d. h.—h.	d.					
Mar. 17 9—10	12				Traces; through clouds.	
19 8—13	14				Bright arch of brushes.	
21 12—13	16				Bright and rapidly pulsating.	
24 10	19				Faint.	
Apr. 17 10	14				Coloured, but sky overcast with *growing* clouds.	
29 9—13	26				Faint. $11^h\ 10^m$; streamers.	
May 10 11	7				Faint. Streamers.	
18 13	15				Bright. Streamers to 80° alt.; coloured red.	
Sept. 5 12	8				Faint. Lightning. [and thunder.	
Oct. 18 7—11	21				Coloured. $10\frac{1}{2}^h$; corona borealis. 11^h; lightning	
19	22				Faint. Streamers.	
20	23				Traces.	
21	24				Traces.	
22 12	25				Aurora, with streamers. [the 23d?)	
24 10	27				Traces. Overcast. (This may have been on	
26 11	29				Faint.	
Nov. 17 7—13	21				Magnificent, whole sky crimsoned.	
18 9—11	22				10^h; arch about 10° altitude.	
21 7—10	25				Bright. $8^h\ 10^m$; large wing-like patches about the anti-dip.	
22 8—11	26				Bright, but sky overcast with clouds.	
30 10	5				Traces.	
Dec. 17 7—13	22				Brilliant. $8^h\ 40^m$; corona borealis. $11^h\ 40^m$; beautiful wings about its centre.	
21 10	26				Faint. Low on north horizon.	
1849.						
Jan. 5 12—13	11				Aurora, with streamers. [arch 15° alt.	
14 6—11	20				$6^h\ 10^m$; streamers. $9^h\ 40^m$; arch 4° alt. $10^h\ 40^m$;	
15 8—11	21				Diffuse light.	
16 7	22				Traces; through clouds.	
25 8—11	1				Faint diffuse light.	
26 8—11	2				Very faint.	
31 10	7				Trace.	
Feb. 11 10	18				Very faint.	
13 11	20				Very faint. [to N. by E.	
18 8—11	25				$9^h\ 40^m$; rather bright, with pink or red patches	
19 9—12	26				$8^h\ 40^m$; bank to N. $9^h\ 54^m$–58^m; magnificent bow.	
20 9—10	27				$10^h\ 0^m$; bank, or red streamers. Diffuse light.	
21 9	28				Very faint.	
22 7—12	29				$7^h\ 20^m$; finely coloured to N. $11^h\ 48^m$; corona bor.	
24 10	1				Very faint, with low arch.	
26 10	3				Faint.	
28 10	5				Trace. [and streamer.	
Mar. 18 10—11	23				$10^h\ 25^m$; fine arch 73° alt. $10^h\ 32^m$; low light	
19 11—12	24				Faint arch to N.	
Apr. 16 8—11	23				Streamers, and pulsating wings about the centre of the corona borealis.	
17 11	24				Faint.	
After this time little watch was kept for Auroræ.						
Sept. 17 9—11	1				Distinct traces on N. horizon.	
18 13	2				Faint.	
19 11—12	3				Faint.	
Oct. 14 10	28				Faint, with short streamers.	
18	2				Faint streamers.	

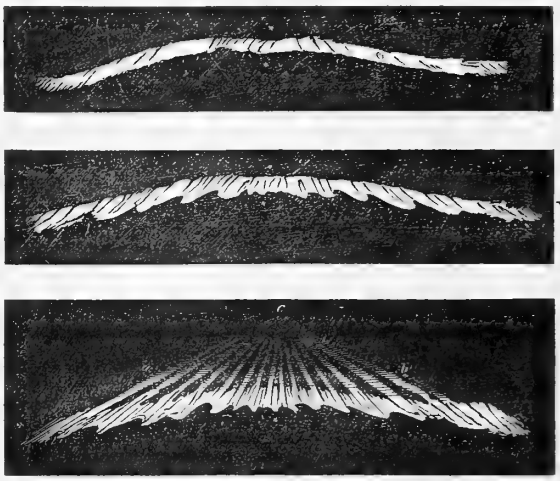
170. The detailed notes on the auroræ seen till January 1847, will be found in the volumes referred to in the last column of the previous Table: in order to render the series more complete, the following additional notes for the year 1847–9 are given. Göttingen mean time has been employed, as in the former volumes, in order that the notes might be comparable with the magnetic observations.

ADDITIONAL NOTES ON AURORÆ BOREALES SEEN IN 1847–9.

1847.	Gött. M. T. d.	h.	
March	19	8	40^m. Aurora of irregular streamers converging to the anti-dip. 44^m. A bright beam from NW., through α and β Aurigæ; persistent for some time. Masses of light at about 10° altitude. The aurora terminates about NE. Cirro-cumulo-strati spreading from NW. 47^m. Diffuse and hazy-like aurora to SW.; patches 20° south of zenith, to SE., &c. 50^m. Arch about 10° altitude, but not very distinct, the moon appears as if in a cirrous haze. 52^m. Patch reaching from zenith to 10° over NNW., becomes a beam immediately. Aurora becoming less bright. The clouds during auroræ often assume a curious brushy appearance. 56^m. Sky nearly covered with auroral haze, which is less bright to S., and more patchy.
		9	20^m. Faint auroral arch nearly complete, 20° altitude from S. 39^m. Sky covered with patches of hazy or milky aurora, both to N. and S.
		10	15^m. Milky aurora over the sky.
Sept.	29		This aurora appeared in amorphous patches, jets, pulsations, and in bands, like portions of arches at $9^h\ 9^m$.
		9	25^m. Aurora not bright, arches with pulsations; broad pencilly patches; about 30^m a long and broad streamer reached from near the horizon to near the zenith, passing through the body of the Great Bear. At $10^h\ 40^m$, the aurora was diffuse, extending to an altitude of 70° or 80°.
Oct.	24	11	The corona very beautiful and perfect at this time, found by carefully examining the position of the centre of the corona with reference to certain stars that it was S. $23\frac{1}{2}$ E., with an altitude of $70\frac{1}{2}°$. Bright pencils and streamers seen till near 14^h; lunar halo at $13^h\ 6^m$.
Nov.	19		Fine coloured aurora; made a few notes about 9^h P.M. as follows:—
		8	$58\frac{1}{2}^m$. White patches in Cygnus; a very persistent red patch on the Pointers, it has moved perhaps 2° eastwards since $52\frac{1}{2}^m$; about 48^m very irregular white streamers on N. horizon.
		9	$1\frac{1}{2}^m$. Bright-red streamers east of Pointers. $2\frac{1}{2}^m$. White patch to WSW. $3\frac{1}{2}^m$. Streaky aurora and streamers; air very clear; stars very distinctly seen and well defined; clouds growing and dissolving. $4\frac{1}{2}^m$. Patch 240° azimuth, 13° altitude. $22\frac{1}{2}^m$. Corona; estimated the position of the centre among the stars, and found it to be S. 25° E. altitude 71°. Considerable magnetic disturbance.
1848.			
Feb.	22	8	50^m. Arch of aurora passed through zenith, and at $8^h\ 55^m$, the arch had reached southwards till its south edge had an altitude of 42°, as found from the position of the arch among the stars: the sky soon clouded over. The aurora was observed about $7^h\ 20^m$; about $8^h\ 50^m$ it was very brilliant with green, white, and red streamers. Several flashes of lightning seen about 10^h. Arches to the south always very faint.
March	19	8	13^m. Very cloudy. Total eclipse of moon at midnight, when there was a very fine arch of aurora, made up of brushes, very bright to NW. by N. Clouds of the growing and dissolving species so common during auroræ.
	21	12	25^m. Sky quite clear, excepting near the horizon, stars bright. Rapidly pulsating and vivid aurora first seen; pulsations seen in the space between NW. and NNW., clouds to N. and W. Slight rain falling, though no cloud near the zenith, and not a breath of wind. About 28^m, cirro-cumulous scud (the growing and dissolving cloud) came moving up from W.; wondered whether the rain would cease or increase when the cloud reached the zenith; found that the rain *ceased* immediately when the cloud crossed the zenith; the pulsations of the aurora at the same time became less frequent; at first they reached from an altitude of 30° to past the zenith. After a portion of the cloud had passed the zenith, leaving a little sky, a few drops of rain were again felt, but the cloud quickly *grew* over the zenith again. The usual growing cloud obscuring the moon becoming more general and denser. Pulsations much less at 32^m.
	24	10	Faint aurora to NNW., mostly covered with thin hazy cloud, radiating from *that* point to an altitude of 45°.
Oct.	18	7	10^m. The sky, where free from clouds, has a reddish tinge, as if from aurora. About 8^h the sky still nearly covered with clouds; beams seen in different parts of the sky, some reaching nearly to zenith, a bright mass of aurora with streamers to W., little or no aurora to N. $9^h\ 10^m$. Sky nearly clear, faint diffuse auroral light over most of the sky. About $10^h\ 20^m$, sky nearly clear, brilliant corona, beams rising from all parts of the sky; mostly white; rapid pulsations. Clouds speedily covered the sky. About $11^h\ 0^m$, a vivid flash of lightning followed in about two seconds by a peal of thunder; heavy shower of hail or snow. The magnets considerably disturbed about 7^h.

Auroræ were seen at Inveresk by Mr Milne's gardener on the following days, when none were observed at Makerstoun, viz., April 24; July 1, 2, 23; and August 8, 1848.

1849.	Gött. M. T. d.	h.	
Feb.	19	8	40^m. Homogeneous auroral bank to N. with slight appearance of an arch.
		9	54^m–58^m. Magnificent bow of aurora passing between Castor and Pollux, as in Fig. 1; shortly afterwards a series of waves seemed to move along the lower edge of the bow from east to west, and in a direction opposite to the very violent wind then blowing from west; the appearance of the waves is shewn in Fig. 2.
		10	10^m. The source of the waves was observed as in Fig. 3; the bow was seen to be at the base of a series of beams, which converged to the anti-dip; the beams were but faintly visible, but they were observed to rotate about the point c, the centre of the corona, the beam a, appearing to occupy successive positions, till it arrived at the position b; in this rotation the wave-like motion observed in Fig. 2, was produced. The sky was quite clear, and the wind blowing very violently. It is not a little curious that on the following evening, Feb. 20th, Professor Forbes observed a similar arch in almost the same position. He has obliged me with the following note of his observation :—



"Edinburgh, 20th February 1849.—At 10^h 10^m, P.M. [Greenwich mean time], my attention was called to a splendid auroral arch; the brightest I ever saw. Sky clear and calm blue, diffuse light in N. At 10^h 11^m. Centre of band over northermost of two bright stars in Gemini (Castor and Pollux). Motion at first a little northwards, but returned to its former position. Undulations of brightness from E. to W. passed along the zone. Began to break up from the E. end about 10^h 18^m; figure became irregular, and, on the whole, to the S. of its first position. 10^h 22^m. Only streaks in the west remaining."

March	18	10	25^m. The arch passed between the stars, 38 and 40 of the Lynx, which were nearly on the meridian; at 10^h 32^m, the arch passed over the two stars, λ and μ Ursæ Majoris.

Diurnal Variation of Visible Frequency of the Aurora Borealis.—When we note from the preceding Table the hours at which auroræ were seen at Makerstoun, we obtain the numbers in the following Table.

TABLE 70.—Number of times that the Aurora Borealis was seen at Different Hours in the Years 1843–9, as deduced from Table 69.

Mak. Mean Time.	Jan.	Feb.	March.	April.	May.	Aug.	Sept.	Oct.	Nov.	Dec.	Nov. Dec. Jan.	Feb. March. April.	Aug. Sept. Oct.	Year.
5 P.M.	1	0	0	0	0	0	0	0	1	3	5	0	0	5
6 ...	4	2	0	0	0	0	1	2	7	3	14	2	3	19
7 ...	10	7	4	1	0	0	2	8	7	6	23	12	10	45
8 ...	9	12	9	3	0	0	5	6	9	4	22	24	11	57
9 ...	10	17	12	6	0	1	10	12	16	7	33	35	23	91
10 ...	8	10	13	12	3	2	7	8	9	3	20	35	17	75
11 ...	4	9	10	7	2	3	5	3	4	3	11	26	11	50
12 ...	4	6	8	7	2	1	2	1	3	3	10	21	4	37
1 A.M.	2	3	5	5	1	3	2	2	2	2	6	13	7	27
2 ...	3	2	3	2	0	0	2	2	0	1	4	7	4	15
3 ...	1	0	2	2	0	0	2	3	0	1	2	4	5	11
4 ...	0	0	0	0	0	0	0	2	0	1	1	0	2	3
5 ...	0	0	0	0	0	0	0	1	0	1	1	0	1	2

171. It is probable that the numbers for midnight, and the hours thereafter, are too small, for the reason given, No. 169. The greatest number of auroræ were seen at 9^h P.M.; this result is independent of the effect of twilight, since 9^h P.M. is also the hour of maximum frequency for the winter months. This hour is nearly the hour of maximum disturbance for the magnetic declination and dip; as, however, the maximum disturbance of the total magnetic force and a maximum of the magnetic dip appear to occur about 5^h P.M., this also may be an epoch of maximum frequency or intensity, though this can only be determined in higher latitudes. It should also be remarked, that, since the epoch of maximum disturbance varies with season, so, therefore, it is probable will that of frequency of the aurora; some traces of this may be deduced from the previous table. In the winter quarter, November–January, four-fifths of the times at which auroræ were seen were for the hours *before* 10^h P.M., whereas in the spring quarter there were only three-fifths seen before 10^h P.M. (See No. 172).

TABLE 71.—Numbers of Auroræ Boreales seen at Makerstoun in each Month of the Years 1843–49.

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Sum.
1843	1	1	4	2	0	0	0	0	3	3	3	3	20
1844	2	3	5	3	3	0	0	2	0	4	6	2	30
1845	11	6	11	4	1	0	0	2	3	4	3	2	47
1846	0	2	1	2	0	0	0	2	4	4	1	1	17
1847	1	1	1	1	0	0	0	1	2	5	5	1	18
1848	0	3	4	2	2	0	0	0	1	7	5	2	26
1849	7	10	2	2	0	0	0	* *	3	2	* *	* *	26
Sum,	22	26	28	16	6	0	0	7	16	29	23	11	184

172. *Annual Variation of Frequency of the Aurora Borealis.*—The first line following contains the numbers of auroræ observed in each month during the six complete years 1843–8, and the second line gives the numbers of hours at which the auroræ were seen.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	16	26	14	6	0	0	7	13	27	23	11
50	62	65	43	8	0	0	10	32	44	58	38

The greatest number of auroræ was observed in March for the first six months, and in October for the last six months of the year: none were observed in June and July. When the six months of 1849 are included, the number for February is 26, and for March, 28. The law of visible frequency of the aurora is the same as that deduced already for magnetic disturbance, namely, maxima near the equinoxes, and minima near the solstices, the minimum at the summer solstice being the principal.* As, however, the shortness of night during the summer months must diminish the number of visible auroræ, it is by no means certain from these numbers that a minimum occurs at the summer solstice; the fact of the minimum at the winter solstice is involved in no such difficulty. If we could assume that the auroræ had the same diurnal law of frequency at all seasons of the year, the existence of the summer minimum could be satisfactorily determined, by comparing the numbers of times which auroræ were seen at the five hours, 10^h P.M.–2^h A.M., during

* It has been stated in the volume for 1844, p. 401, that this result was long ago obtained by Mairan; this statement, made chiefly on the authority of Kæmtz and Hansteen, is not quite accurate. It is true that Mairan's numbers give a rough indication of the law, as will be seen below; but when it is remembered that his table includes all the observations (229) of which he could find a record for upwards of 1000 years, it will be evident, that the conclusion that a greater number of auroræ occurred at both equinoxes than at the winter solstice would have been hasty; this conclusion, however, is *not* made by Mairan, and, though he has combined the numbers of auroræ in a great variety of ways, he has made no combination exhibiting this fact. It did not enter into the necessities of his theory (that auroræ are the product of the solar atmosphere) to shew that a greater number of auroræ happened in the northern hemisphere, at the vernal equinox than at the winter solstice; he shews, indeed, that the number for one equinox is, and, in accordance with his theory, ought to be, greater than for the other. Some other philosopher has the merit of first pointing out this fact.

The following are the numbers of auroræ by Mairan (Traité Physique et Historique de l'Aurore Boreale, par M. de Mairan,

which (even in the months of August and May) there is little twilight to extinguish auroræ. The numbers are as follow, for these five hours in each month of the years 1843–8 :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	24	38	31	8	0	0	9	14	16	18	12

From these it is evident that the numbers in May and August are certainly less than for April and September; but it has been already mentioned as probable that the diurnal law of frequency varies with season, of which, indeed, a proof is to be found in the great excess of the numbers above for the spring months, compared with those for the autumn months, shewing the later epoch of the maximum frequency in the former. An examination of Table 18, however, will shew, that, though the maximum disturbance occurs after midnight, in the months of May, June, and July, yet in August and the two following months it occurs about 10^h P.M., so that there can be no doubt of the less number for August than for September and October, if there should be a doubt in the case of May compared with April. The difference, however, even in the latter case is too great to be explained by any slight shift of the epoch of maximum frequency in the two months. Upon the whole, it appears certain that a minimum of actual as well as of visible frequency occurs in summer; a result quite in accordance with that for the amount of magnetic disturbance, which accordance is sufficiently close to permit us to complete it, by assuming that the number of auroræ is a *principal* minimum in summer.

173. *Variation of Frequency of the Aurora Borealis with the Moon's Age.*—This investigation is evidently beset with considerable difficulty, since the moonlight existing nearly extinguishes the appearances of all the fainter class of auroræ, and it renders the faintest wholly invisible; the careful watch, however, which was kept for auroral appearances at Makerstoun, probably renders Table 69 better fitted for such a question than any previous series of observations.*

174. Combining the numbers of auroræ observed at each day of the moon's age into six groups of 5 days (the first group, $4\frac{1}{2}$ days), we find the average number of auroræ for one day of the moon's age in each group as follows, from the $6\frac{1}{2}$ years' observations :—

Moon's Age.	28^d—2^d	3^d—7^d	8^d—12^d	13^d—17^d	18^d—22^d	23^d—27^d
Number.	5·8	5·2	3·6	5·0	10·2	6·6

Did auroræ *occur* indifferently at all ages of the moon, we should expect to *see* the greatest number at conjunction, and the least number at opposition; this however is not the case, the greatest number was seen about two days before the end of the third quarter, and the least number about two days after the first quarter, or the visible maximum and minimum occurred at times *equidistant* from the epoch of opposition. The frequency of auroræ, therefore, is a function of the moon's age. In order to determine the actual law, we may consider the probable effect of moonlight in obliterating the auroral appearances; remarking, first, that 9^h P.M., is the epoch of maximum frequency for the aurora, and that upwards of five-sixths are seen before midnight. When the moon is about three days old, in the months from September to March, it begins to set sufficiently late, and to have sufficient light to render the earlier of the faint auroræ invisible; about the end of the first quarter, it does not set till midnight, and thus shines throughout the period of the occurrence of five-sixths of the auroræ; afterwards it increases in brightness, and the maximum effect in extinguishing faint auroræ is evidently attained at opposition, when the moon begins to rise late enough to allow the earlier auroræ to be visible; towards the end of the

1733, p. 199); by Kæmtz (Complete Course of Meteorology, translation by Walker, p. 458); and by Hansteen (Mem. de l'Acad. Roy. de Belgique, t. xx., p. 117).

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Sum.
Mairan, .	21	27	22	12	1	5	7	9	34	50	26	15	229
Kæmtz,	229	307	440	312	184	65	87	217	405	497	285	225	3253
Hansteen,	29	31	47	34	2	0	0	17	35	33	34	23	285
J. A. Broun,	22	26	28	16	6	0	0	7	16	29	23	11	184
Sum of last three,	280	364	515	362	192	65	87	241	456	559	342	259	3722

Mairan's numbers are probably included by Kæmtz; a few of the auroræ, included in M. Hansteen's list, are identical with those in my own.

* It should be remarked, that the latitude of Makerstoun, or perhaps even a lower latitude, is better fitted for this investigation, than much higher latitudes; at least this is the case as long as only frequency of visibility can be considered. The French *Commission du Nord*, during their stay in Lapland, found auroræ existing, or probably existing, almost every night. In such places variation of frequency there is none, and variation of intensity alone remains for investigation. It is obvious, that till some better mode of measuring this intensity can be devised for these high latitudes, we are forced to perform this operation in a rude manner, by moving to lower latitudes, where the fainter auroræ become invisible, and where, therefore, frequency is a test of intensity beyond a certain limit.

third quarter, when the moon does not rise till midnight, it is also evident that the number of faint auroræ rendered invisible must be very small. From the beginning of the fourth quarter, therefore, till conjunction, the numbers *seen* will obey nearly the true law of frequency; and as the visible maximum occurred before the end of the third quarter, the true maximum must have occurred even nearer to opposition. On the whole, it appears very certain, that the hypothesis of an actual maximum of frequency at opposition and minimum at conjunction, is satisfied by the previous numbers of auroræ, seen under the conditions of the varying duration of moonlight for the hours of maximum frequency. This hypothesis is in unison with the law of magnetic disturbance, which is a maximum at opposition, and a minimum at conjunction.

NOTE ON THE THEORY OF THE AURORA.

175. Although temptations to frame hypotheses have been avoided hitherto, I cannot refrain from repeating here, the opinion, that the phenomena of the aurora borealis are chiefly optical. After watching the various phases of the aurora for some years, the hypothesis of self-luminous beams and arches appeared to me unsatisfactory, and the strongest argument in its favour, that obtained from the computed height of the auroral arches, seemed of a very doubtful character. I was quite prepared, therefore, to adopt the idea, first I believe proposed by M. Morlet to the French Academy, in May 1847, that the auroral arch is an optical phenomenon of position. M. Morlet has pointed out that the arch appears generally as a segment of a circle, whereas, in these latitudes, it ought invariably to appear as the segment of an ellipse, if the hypothesis be true, of a real luminous ring, with its centre on the continuation of the magnetic pole. He has also, among many other very obvious objections to that hypothesis, shewn that the summit of the arch is generally in the magnetic meridian of the place, the plane of which rarely passes through the magnetic pole, and seldom passes through the same point, for three different places. I have, however, felt even more persuaded, that the aurora is, partly at least, an optical phenomenon, from a consideration of that phase of the aurora constituting the corona borealis, a persuasion that I stated, in the Literary Gazette of the time, in giving an account of the beautiful corona of October 24, 1847. Mairan and, more lately, Dalton, have explained this phase of the aurora by a hypothesis of polar beams, long fiery rods of solar atmosphere, according to the one, of red-hot ferruginous particles according to the other, seen in perspective, as they lie in the direction of the magnetic force. A little acquaintance with the phenomenon—the rushing and tilting of the beams against each other, one beam occasionally rising from the horizon, passing through the centre of the crown and beyond it—would shew the improbability of this hypothesis. I am persuaded, that the phenomenon of the corona borealis is produced in a narrow horizontal stratum of the earth's atmosphere. Thanks to the discoveries of Dr Faraday, we do not now require a ferruginous sea, in order to have polarized particles; the watery crystals that inhabit the upper regions of the atmosphere can themselves assume a polar state, determined by the passage of electric currents; and we have only to complete this fact by a hypothesis of luminous electric discharges seen refracted by these crystals, the position of visibility of the refracted rays depending on the angles of the crystals, and the deflections from the direction of magnetic force, which they suffer by the electric currents. Such a hypothesis, which occurs at once when an optical phenomenon has to be accounted for, would explain these remarkable auroral clouds, so often seen in connection with the aurora itself; it would also serve to explain the appearance of the arch at certain altitudes, lower for lower altitudes, determined by the position of the source of light, direction of the magnetic force at the place, and the effect of the electric current in deflecting the crystals. The crystals successively deflected by electric currents, would also exhibit the rushing pencils or beams. It need scarcely be remarked that differently formed crystals might give rise to different phases of the phenomenon, while reflection might be combined with refraction in certain cases, especially in the case of arches seen south of the anti-dip. Such a hypothesis evidently assumes a source of light, independent of these optical resultants, and the pulsations seen in many auroræ may be real luminosities. It is hazardous, in the present ill-arranged state of auroral observation, to offer so rude a sketch of a new hypothesis, although we may suffer a considerable defeat in very good company.

Since the previous note was written, I find that M. Morlet has published a theory of the auroral arch (Ann. de Ch., t. xxvii., 3me Série). The ideas above were stated by me two years ago, to different persons.

METEOROLOGICAL RESULTS.

TEMPERATURE OF THE AIR.

TABLE 72.—Monthly Means of the Temperature of the Air at Makerstoun, for the Years 1841–9.

Month.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Mean 1842–9.	Monthly Variations.
	°	°	°	°	°	°	°	°	°	°	°
January		33·90	38·43	37·35	34·71	41·06	33·70	32·54	36·68	36·05	− 9·98
February		38·74	32·92	32·48	32·96	42·52	33·85	38·67	39·86	36·50	− 9·53
March		41·06	39·40	38·36	35·39	39·96	40·77	39·99	40·81	39·47	− 6·56
April		45·32	44·79	46·77	44·33	42·32	41·25	41·08	39·06	43·11	− 2·92
May		50·82	46·54	48·49	46·37	51·15	50·76	56·60	50·42	50·14	+ 4·11
June		57·09	51·35	54·14	55·66	61·20	55·71	54·50	53·24	55·36	+ 9·33
July		56·10	56·55	55·55	54·14	58·65	60·67	58·11	56·27	57·00	+10·97
August	55·05	59·90	57·12	54·08	54·60	59·16	56·58	53·20	56·23	56·38	+10·35
September	52·28	53·08	55·67	52·30	50·06	55·69	49·11	51·73	51·82	52·43	+ 6·40
October	43·32	44·49	42·93	45·74	47·86	47·58	47·50	45·99	45·49	45·95	− 0·08
November	36·45	39·98	39·38	42·85	41·94	43·02	44·38	40·20	41·05	41·60	− 4·43
December	.....	45·47	45·50	32·04	37·08	32·53	38·37	39·22	36·71	38·36	− 7·67
Year.	.....	47·17	45·88	45·01	44·59	47·90	46·05	45·99	45·64	46·03	

176. *Mean Temperature at Makerstoun.*—The mean temperature of the air in the shade, as deduced from observations in the 8 years, 1842–9,

= 46°·03, with a probable error of 0°·24.

The year 1845 had the lowest mean temperature and the year 1846 had the highest, the former being 1°·44 less than the mean of the 8 years, and the latter being 1°·87 more.

The mean temperature at Makerstoun for any future year = 46°·0, with a probable error of 0°·7.

Naming the three coldest months, the meteorological winter, the three hottest, summer, and the intermediate quarters, spring and autumn, we find their mean temperatures at Makerstoun, as follows :—

Meteorological Winter,	Dec., Jan., Feb.,	Mean Temperature	= 36°·97
Spring,	March, April, May,	.....	= 44°·24
Summer,	June, July, Aug.,	.....	= 56°·25
Autumn,	Sept., Oct., Nov.,	.....	= 46°·66

177. *Annual Variation of Temperature.*—By the monthly means from the 8 years' observations

The maximum temperature occurred approximately July 22
The minimum temperature ..... January 27
The mean temperature ..... April 29 and October 14

The lowest monthly mean temperature occurred in 4 years in January, in 2 years in December, and in 2 years in February. The highest monthly mean temperature occurred in 4 years in July, in 2 years in June, and in 2 years in August.

The highest monthly mean temperature occurred June 1846, = 61°·20
The lowest monthly mean temperature occurred December 1844, = 32°·04
The range of the monthly mean temperature in 8 years therefore = 29°·16

The greatest yearly range of monthly mean temperature occurred in 1846, = 28°·67
The least ..... 1849, = 19°·59

The difference between the temperatures of the hottest and coldest months in the mean of 8 years = 20°·95
..... 2 months ..... = 20°·42
..... 3 months ..... = 19°·28

178. We may employ the monthly means in the 11th column of Table 72, for the purpose of predicting the mean temperature for a coming month, the probable error of the predicted temperature for each month as deduced approximately from the Table, being as follows :*—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2°·0	2°·9	1°·1	1°·9	1°·9	1°·7	1°·4	1°·5	1°·5	1°·1	1°·2	3°·2

Thus, at Makerstoun, there are equal chances that the mean temperature of any month of March will not be more than 1°·1 from 39°·5. The months of March, October, and November, shew the least variation of monthly mean temperature ; the months of December, January, and February shew the greatest variation.

TABLE 73.—Monthly Means of the Diurnal Ranges of Temperature, as deduced from the Observations of the Register Thermometers, for the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1843	9·0	7·8	14·1	15·2	13·3	13·6	16·7	20·2	20·8	13·6	12·4	8·1	13·7
1844	10·9	11·7	13·1	18·4	19·4	18·2	18·7	19·5	15·9	13·4	8·4	6·8	14·5
1845	11·9	12·1	14·0	20·2	14·2	18·7	17·1	17·1	17·9	12·0	12·6	11·0	14·9
1846	8·6	10·6	14·7	14·3	18·1	24·9	16·6	18·8	19·3	13·9	9·0	11·0	15·0
Mean	10·1	10·5	14·0	17·0	16·2	18·8	17·3	18·9	18·2	13·2	10·6	9·2	14·5

179. *Annual Variation of the Diurnal Range of Temperature.*—From the last line of Table 73, the mean of the diurnal ranges of temperature was least in December, and it was greatest in June and August. It appears probable, however, that when a sufficient number of years' observations is considered, the mean of the diurnal ranges will be found to vary little from April till September. This result is analogous to that obtained for the ranges of the mean undisturbed diurnal variations of the magnetic elements.

The ranges of the monthly mean diurnal variations, from the hourly observations in the two years 1844–5, are as follow :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5°·60	7°·05	9°·30	14°·70	11°·80	12°·15	12°·00	12°·35	12°·60	8°·20	5°·05	3°·70

These quantities indicate a result quite similar to that obtained from Table 73, though, as might be expected, the ranges are considerably smaller. December has the least range, and May, June, and July have rather less ranges than April, August, and September.

TABLE 74.—Mean Differences of the Daily Mean Temperature from the Monthly Mean for each Month in the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1843	5·45	4·40	4·63	4·21	2·08	3·44	1·57	2·48	4·42	6·98	4·44	2·69	3·90
1844	4·30	4·20	4·43	2·62	2·69	3·00	3·33	1·62	2·07	4·50	3·90	3·20	3·32
1845	6·02	3·21	6·08	3·97	2·46	3·34	2·16	1·86	3·32	3·04	4·69	3·12	3·61
1846	4·21	4·20	4·67	2·85	2·15	4·47	2·57	2·80	3·61	3·87	4·82	4·60	3·73
Mean	5·00	4·00	4·95	3·41	2·34	3·56	2·40	2·19	3·35	4·62	4·46	3·40	3·64

* These numbers divided by 3 will give approximately the probable errors of the monthly means in the 11th column of Table 72 as the true monthly mean temperatures at Makerstoun.

180. *Differences of the Daily Mean Temperature from the Monthly Means.*—From the means of the results for the four years 1843–6 in the last line of Table 74, the differences of the daily mean temperature from the monthly mean temperature are greatest in the six months October to March, and they are least in the remaining six months; there are irregularities in the value of the mean difference from month to month; the mean difference is less in December than in the immediately preceding and succeeding months, and it has nearly the same value as in June. The mean difference is greatest in January, and it is least in August. From the four years' observations the mean temperature of a civil day differs on the average 3°·6 from the mean temperature for the corresponding month.

181. The irregularity of the monthly mean temperature does not seem to be connected with that of the daily mean temperature; thus, March and October, which have the least variation of monthly mean temperature, have the greatest variation of daily mean temperature, with the exception of January.

182. *Diurnal Variation of Temperature.*—Table 75 has been formed in the manner already described for Table 12. The approximate epochs deduced from Table 75 are given in Table 76.

TABLE 75.—Diurnal Variation of the Temperature of the Air for each Astronomical Season and for the Year, deduced from the Observations of the Years 1843–6.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. Mar. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	°	°	°	°	°	h. m.	°	°	°	°	°
12 10	−0·99	−3·06	−4·82	−3·84	−3·18	0 10	+2·60	+4·72	+5·42	+5·84	+4·64
13 10	−0·98	−3·32	−5·22	−4·24	−3·44	1 10	+3·04	+5·30	+5·88	+6·42	+5·16
14 10	−1·10	−3·56	−5·61	−4·58	−3·71	2 10	+2·86	+5·43	+5·72	+6·61	+5·16
15 10	−1·15	−3·67	−6·01	−4·86	−3·92	3 10	+1·99	+5·04	+5·50	+6·08	+4·65
16 10	−1·22	−3·87	−5·72	−5·04	−3·96	4 10	+0·92	+4·11	+4·83	+4·98	+3·71
17 10	−1·26	−3·80	−4·65	−5·12	−3·71	5 10	+0·24	+2·62	+3·96	+3·28	+2·52
18 10	−1·34	−3·30	−2·81	−4·31	−2·94	6 10	−0·31	+1·14	+2·49	+1·55	+1·22
19 10	−1·33	−2·35	−0·93	−2·82	−1·86	7 10	−0·40	−0·16	+0·90	−0·04	+0·07
20 10	−1·18	−0·99	+0·99	−0·53	−0·43	8 10	−0·54	−0·99	−1·05	−1·14	−0·93
21 10	−0·32	+0·87	+2·51	+1·62	+1·17	9 10	−0·67	−1·66	−2·35	−2·18	−1·72
22 10	+0·77	+2·70	+3·72	+3·59	+2·69	10 10	−0·76	−2·29	−3·48	−2·93	−2·36
23 10	+1·84	+3·88	+4·88	+5·03	+3·91	11 10	−0·70	−2·71	−4·15	−3·32	−2·72

TABLE 76.—Principal Epochs in the Diurnal Curve of Temperature, deduced from Table 75.

Period.	Minimum A. M.	Mean A. M.	Maximum P. M.	Mean P. M.	Intervals.			
					A. M. Mean to Maximum.	P. M. Mean to Maximum.	A. M. Mean to P. M. Mean.	Minimum to Sunrise.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Nov. Dec. Jan.	6 40	9 30	1 33	5 39	4 3	4 6	8 9	1 26
Feb. Mar. Apr.	4 32	8 34	1 45	6 55	5 11	5 10	10 21	1 35
May June July	3 35	7 39	1 15	7 38	5 36	6 23	11 59	0 2
Aug. Sept. Oct.	5 10	8 30	2 0	7 13	5 30	5 13	10 43	0 30
Year	3 45	8 26	1 40	7 14	5 14	5 34	10 48	2 8

The following are the conclusions from the previous table:—

1*st*, The minimum temperature occurs immediately before sunrise in summer, about 1½ hours before it in winter and spring, and about half-an-hour before sunrise in autumn; it is evident, however, that accuracy in the determination of the interval is not increased by combining several months together, since, in the result for the year, the minimum appears to occur at a greater interval from sunrise than in any of the quarters.

2*d*, The maximum temperature occurs latest after noon before the autumnal and after the vernal equinox; it occurs nearest noon in summer, but the temperature changes very slowly in that quarter from 1^h to 3^h P.M.

3*d*, The intervals between the epochs of mean temperature and of the maximum temperature are nearly equal in spring and autumn; the afternoon interval is greatest in summer, and it is least in winter. If we except summer, the temperature increases as rapidly from the mean to the maximum, as it diminishes from the maximum to the mean; the slight difference in autumn between the values of the intervals, and even that in summer may be due to error in the epoch of maximum resulting from the fewness of the observations. In each quarter, with the exception of summer, the temperature diminishes more rapidly after the maximum till sunset than it increased during equal time before the maximum.* It will be seen from the column for the year, in Table 75, that the mean temperature for the pairs of hours before and after 1^h and 2^h P.M., are equal or nearly equal till the pair $9^h\ 10^m$ A.M. and $6^h\ 10^m$ P.M., which are also nearly equal, so that the mean diurnal curve for the year from $9^h\ 10^m$ A.M. till $6^h\ 10^m$ P.M. is symmetrical about a vertical axis.

PRESSURE OF AQUEOUS VAPOUR.

TABLE 77.—Mean Pressure of Aqueous Vapour for each Month in the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1843	0·220	0·184	0·223	0·253	0·281	0·320	0·387	0·409	0·382	0·245	0·238	0·280	0·283
1844	·216	·180	·209	·258	·273	·354	·367	·355	·351	·276	·258	·187	·274
1845	·203	·181	·185	·251	·276	·374	·358	·366	·317	·297	·252	·207	·272
1846	·251	·249	·222	·254	·298	·409	·425	·443	·397	·306	·269	·187	·309
Mean	·222	·198	·210	·254	·282	·364	·384	·393	·362	·281	·254	·215	·285

183. *Annual Variation of the Pressure of Aqueous Vapour.*—The pressure of aqueous vapour, as deduced from the observations of the dry and wet bulb thermometers, is least in February, being in the mean of 4 years = 0·198 inch of mercury, and it is greatest in August = 0·393 inch, the difference between the greatest and least monthly means being nearly two-tenths of an inch. The mean pressure for each of the four months December to March varies little; so also for the four months June to September.

The mean pressure for the four months December to March from 4 years' observations = 0·211 inch.
..... June to September..... = 0·381 ...
The mean pressure of aqueous vapour for the 4 years 1843–6 = 0·285 ...

TABLE 78.—Variations of the Pressure of Aqueous Vapour with reference to the Moon's Age and Declination for the Years 1843–6.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	in.	in.	in.	in.	in.	d. d.	in.	in.	in.	in.	in.
14—16	·000	+·004	+·007	+·012	+·006	27— 1	−·030	−·001	−·017	−·001	−·012
17—20	+·008	+·011	−·005	+·002	+·004	2— 5	−·003	−·002	+·001	−·020	−·006
21—24	+·009	+·015	−·021	−·011	−·002	6— 8	−·022	−·010	+·017	+·002	−·003
25—28	−·001	−·005	+·010	+·003	+·002	9—12	+·016	+·001	+·007	+·003	+·007
29— 1	−·003	−·013	+·007	+·002	−·002	13—15	+·002	+·007	−·003	+·001	+·002
2— 5	−·020	−·004	−·010	−·008	−·010	16—19	+·017	−·006	−·004	+·008	+·004
6— 9	+·006	+·008	+·007	+·002	+·006	20—22	−·003	+·007	·000	+·006	+·002
10—13	−·001	−·017	+·008	−·005	−·004	23—26	+·021	+·003	−·004	·000	+·005

184. *Variations of the Pressure of Aqueous Vapour with Reference to the Moon's Age.*—Though it has not been possible to determine by our apparatus the heating effect of the moon, yet it is believed that it has some

* The difference betwixt this result and that obtained by others is due, it is conceived, to the want of proper precautions to avoid the effects of radiation or reflection of the sun's heat from the soil or surrounding objects in the afternoon. It will be seen, in the Introductions to the several volumes, that this source of error was cared for at Makerstoun.

effect, especially on the aqueous contents of our atmosphere; in order if possible to determine this, the discussions, of which the results are contained in Table 78, were made for each year; the means of the 4 years indicate as follows,—

1*st*, That on the whole, the pressure of aqueous vapour was greater about opposition than about conjunction; the average pressure of each of the 15 days forming the second and third quarters being 0·003 inch above the mean, and of each of the 15 days forming the fourth and first quarters being 0·003 inch below the mean.

2*d*, That the pressure of aqueous vapour was greatest from about the period of the moon's farthest southerly position, till near its farthest northerly position; that it was least from its farthest northerly position till it was nearly farthest south.

3*d*, If the first result be considered true, then the aqueous vapour pressure varies with the moonlight; as this pressure is greatest in the months from June to September (No. 183), during which the moon is in conjunction in its ascent from its most southerly declination, and least in the months from December to March, during which it is in conjunction in its descent from its most northerly position, the second result is probably a consequence of the first.

TABLE 79.—Diurnal Variation of the Pressure of Aqueous Vapour for each Astronomical Season and for the Year, deduced from the Observations of the Years 1843-6.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	in.	in.	in.	in.	in.	h. m.	in.	in.	in.	in.	in.
12 10	−0·005	−0·007	−0·013	−0·015	−0·010	0 10	+0·011	+0·012	+0·015	+0·024	+0·015
13 10	− ·005	− ·009	− ·016	− ·018	− ·012	1 10	+ ·013	+ ·011	+ ·015	+ ·024	+ ·016
14 10	− ·005	− ·010	− ·020	− ·024	− ·015	2 10	+ ·012	+ ·011	+ ·016	+ ·023	+ ·015
15 10	− ·005	− ·012	− ·024	− ·025	− ·017	3 10	+ ·009	+ ·008	+ ·013	+ ·021	+ ·013
16 10	− ·005	− ·014	− ·024	− ·028	− ·018	4 10	+ ·005	+ ·007	+ ·012	+ ·019	+ ·011
17 10	− ·005	− ·012	− ·017	− ·030	− ·016	5 10	+ ·002	+ ·006	+ ·013	+ ·017	+ ·009
18 10	− ·004	− ·010	− ·005	− ·024	− ·011	6 10	− ·001	+ ·002	+ ·009	+ ·014	+ ·006
19 10	− ·005	− ·005	+ ·001	− ·011	− ·005	7 10	− ·002	+ ·001	+ ·008	+ ·010	+ ·004
20 10	− ·004	·000	+ ·006	+ ·003	+ ·001	8 10	− ·003	·000	+ ·004	+ ·004	+ ·001
21 10	− ·001	+ ·004	+ ·008	+ ·014	+ ·006	9 10	− ·003	− ·003	− ·002	− ·004	− ·003
22 10	+ ·004	+ ·007	+ ·010	+ ·019	+ ·010	10 10	− ·004	− ·004	− ·006	− ·009	− ·006
23 10	+ ·008	+ ·010	+ ·012	+ ·022	+ ·013	11 10	− ·005	− ·004	− ·010	− ·015	− ·008

185. *Diurnal Variation of the Pressure of Aqueous Vapour.*—The following are the approximate epochs of the minimum and maximum, as deduced from Table 79.

Winter,	Nov., Dec., Jan.,	Minimum,	11^h P.M.—7^h A.M.	Maximum,	1^h 30^m P.M.
Spring,	Feb., March, April,	.....	4^h 10^m A.M.	.....	0^h 40^m P.M.
Summer,	May, June, July,	.....	3^h 50^m A.M.	.....	1^h 30^m P.M.
Autumn,	Aug., Sept., Oct.,	.....	5^h 10^m A.M.	.....	0^h 40^m P.M.
	Year,	.....	4^h 0^m A.M.	.....	1^h 10^m P.M.

These epochs do not differ greatly from those for the temperature of the air, the principal difference is to be found in the variation of the epochs of maximum with season; the maximum pressure of aqueous vapour occurs earliest near the equinoxes, and latest near the solstices, whereas the reverse is the case for the temperature of the air. In the mean for the year, the mean pressure of aqueous vapour occurs at 8^h 0^m A.M., and at 8^h 25^m P.M., the interval being 12^h 25^m.

The range of the diurnal variation for the	Winter quarter	= 0·018 inch.
.....	Spring	= 0·026 ...
.....	Summer	= 0·040 ...
.....	Autumn	= 0·054 ...
.....	Year	= 0·034 ...

The range of the mean diurnal variation, therefore, gradually increases from the winter quarter till the autumn, when it is largest, the ratio of the ranges for the four quarters being as 6 : 9 : 13 : 18 nearly. This variation of the range is neither related to the range of temperature, nor to the absolute value of the pressure of aqueous vapour.

RELATIVE HUMIDITY.

TABLE 80.—Mean Relative Humidity of the Air for each Month in the Years 1843–6, Saturation being equal to Unity.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1843	0·852	0·873	0·855	0·800	0·845	0·803	0·820	0·850	0·837	0·860	0·904	0·878	0·848
1844	·935	·882	·828	·775	·768	·819	·808	·818	·852	·848	·882	·941	·846
1845	·919	·857	·811	·811	·831	·813	·834	·835	·842	·841	·875	·851	·843
1846	·896	·844	·836	·859	·766	·736	·834	·861	·874	·890	·897	·901	·850
Mean	·900	·864	·832	·811	·802	·793	·824	·841	·851	·860	·889	·900	·847

186. *Annual Variation of the Relative Humidity.*—The relative humidity is least in June, and it is greatest in December and January; the three months, April, May, and June, have the least mean, = 0·802; the three months, November, December, and January, have the greatest mean, = 0·896. The means for the astronomical seasons are as follow:—

Winter,	Nov., Dec., Jan.,	= 0·896	Summer,	May, June, July,	= 0·806
Spring,	Feb., March, April,	= 0·836	Autumn,	Aug., Sept., Oct.,	= 0·851

Year, = 0·847, Saturation being equal to Unity.

TABLE 81.—Variations of the Relative Humidity with reference to the Moon's Age and Declination, for the Years 1843–6.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.						d. d.					
14—16	−·008	+·009	+·008	+·011	+·005	27— 1	−·010	−·016	−·007	−·006	−·010
17—20	+·012	+·012	+·014	−·014	+·006	2— 5	−·003	−·003	−·008	+·003	−·003
21—24	+·010	+·001	−·010	−·006	−·001	6— 8	−·001	−·001	+·002	+·001	·000
25—28	+·009	+·001	·000	+·022	+·008	9—12	−·010	+·017	+·009	−·016	·000
29— 1	−·005	−·014	−·003	+·003	−·006	13—15	+·013	+·012	−·001	+·003	+·007
2— 5	−·006	+·007	−·003	−·020	−·005	16—19	−·025	−·015	·000	+·024	−·004
6— 9	+·002	−·008	+·002	+·013	+·002	20—22	+·018	+·006	+·014	−·005	+·008
10—13	−·014	−·009	−·005	−·011	−·010	23—26	+·017	−·001	−·007	−·004	+·001

187. *Variations of the Mean Relative Humidity, with Reference to the Moon's Age and Declination.*—The object of this discussion has been already stated, No. 184; the results here are considerably more indistinct than in the former case; they agree on the whole, however; the pressure of aqueous vapour and the relative humidity following nearly the same law; which might be expected if the temperature of the air be supposed not to vary with the moon's position. The relative humidity is greatest at and after conjunction; it is least at and after opposition. It is greatest while the moon is ascending from its most southerly position, and least when most northerly. (See No. 184 3*d*).

TABLE 82.—Diurnal Variation of the Relative Humidity of the Air, for each Astronomical Season and for the Year, deduced from the Observations of the Years 1843–6.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.						h. m.					
12 10	+0·013	+0·061	+0·103	+0·072	+0·062	0 10	−0·035	−0·090	−0·109	−0·106	−0·085
13 10	+ ·014	+ ·065	+ ·105	+ ·075	+ ·065	1 10	− ·043	− ·107	− ·118	− ·122	− ·097
14 10	+ ·012	+ ·069	+ ·105	+ ·072	+ ·064	2 10	− ·044	− ·110	− ·112	− ·130	− ·099
15 10	+ ·014	+ ·065	+ ·109	+ ·078	+ ·066	3 10	− ·027	− ·106	− ·112	− ·120	− ·091
16 10	+ ·017	+ ·064	+ ·101	+ ·075	+ ·064	4 10	− ·009	− ·090	− ·102	− ·096	− ·074
17 10	+ ·018	+ ·066	+ ·087	+ ·072	+ ·061	5 10	+ ·001	− ·052	− ·079	− ·058	− ·047
18 10	+ ·022	+ ·058	+ ·062	+ ·064	+ ·051	6 10	+ ·003	− ·027	− ·051	− ·016	− ·023
19 10	+ ·019	+ ·050	+ ·023	+ ·052	+ ·036	7 10	+ ·003	+ ·009	− ·012	+ ·018	+ ·004
20 10	+ ·021	+ ·027	− ·017	+ ·019	+ ·012	8 10	+ ·007	+ ·028	+ ·031	+ ·038	+ ·026
21 10	+ ·007	− ·010	− ·054	− ·019	− ·019	9 10	+ ·009	+ ·037	+ ·059	+ ·051	+ ·039
22 10	− ·005	− ·054	− ·077	− ·057	− ·048	10 10	+ ·007	+ ·053	+ ·078	+ ·060	+ ·049
23 10	− ·027	− ·073	− ·103	− ·085	− ·072	11 10	+ ·004	+ ·060	+ ·088	+ ·057	+ ·052

188. *Diurnal Variation of the Relative Humidity.*—The following are the approximate epochs of maxima and minima, as obtained from Table 82.

Winter,	Nov., Dec., Jan.,	Maximum 7^h A.M.	Minimum $1^h\ 50^m$ P.M.
Spring,	March, April, May,	..... 3^h A.M.	..... $1^h\ 50^m$ P.M.
Summer,	June, July, Aug.,	..... 3^h A.M.	..... $1^h\ 20^m$ P.M.
Autumn,	Sept., Oct., Nov.,	..... 3^h A.M.	..... $2^h\ 10^m$ P.M.
	Year,	..... 3^h A.M.	..... $1^h\ 40^m$ P.M.

The diurnal variation of relative humidity is nearly the inverse of that of the temperature of the air.

The mean relative humidity occurs at $8^h\ 33^m$ A.M., and at $7^h\ 1^m$ P.M., the interval being $10^h\ 28^m$.

The range of the diurnal variation is least in winter, = 0·066; it is greatest in summer, = 0·227; the values of the range for spring being 0·179, and for autumn being 0·208.

ATMOSPHERIC PRESSURE.

189. *The Mean Pressure of the Atmosphere at Makerstoun*, 213 feet above the mean level of the sea, as deduced from the observations in the 8 years 1842–9, =29·615 inches of mercury at 32° Fahrenheit, measured on brass at 62° Fahrenheit; with a probable error of 0·009 inch, each year's mean receiving an equal weight.

The mean pressure for any future year = 29·615 inches, with a probable error of 0·026 inch.*

TABLE 83.—Monthly Means of the Atmospheric Pressure at Makerstoun, for the Years 1841–9.

Month.	1841.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	Mean of 8 Years.	
										Height of 213 feet.	Mean Level of Sea.
		in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.		29·584	29·357	29·693	29·512	29·392	29·604	29·722	29·508	29·547	29·786
Feb.		·611	·499	·321	·704	·617	·625	·194	·819	·549	·788
March		·485	·662	·529	·741	·406	·775	·354	·755	·588	·826
April		·946	·487	·805	·642	·535	·455	·595	·450	·614	·850
May		·626	·620	·980	·703	·648	·599	·770	·796	·718	·951
June		·764	·619	·627	·597	·706	·672	·475	·735	·649	·879
July		·665	·635	·625	·622	·556	·794	·619	·583	·637	·865
Aug.	29·567	·723	·656	·489	·578	·691	·751	·526	·658	·634	·863
Sept.	·483	·652	·935	·817	·645	·732	·605	·717	·792	·737	·970
Oct.	·372	·682	·401	·397	·602	·312	·646	·551	·606	·525	·758
Nov.	·453	·448	·471	·563	·323	·655	·643	·601	·530	·529	·765
Dec.	.....	·649	·962	·892	·369	·599	·490	·542	·723	·653	·892
Mean		·653	·609	·645	·586	·571	·638	·555	·663	·615	·846

* All the observations are reduced to the *mean* of the flint and crown glass barometer of the Royal Society of London. In comparing these results with others reduced to the flint-glass barometer only, a correction of + 0·003 in. should be applied. See Introduction 1844, page lv.

190. *Annual Variation of the Atmospheric Pressure.*—Eight years' observations appear insufficient for an accurate determination of this law. If we give the monthly means for each year equal weight, we find the probable error of the means in the last column of Table 83 to be

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0·043	0·045	0·037	0·040	0·028	0·020	0·016	0·021	0·024	0·030	0·025	0·044

The probable errors of the means for the five months December to April are greatest, and they are least for the months June, July, and August. The irregularity of the monthly mean pressure is therefore least at the hottest season, and greatest at the coldest season of the year; it does not vary, however, with the irregularity of the monthly mean temperature. (See No. 178.) It is evident from these probable errors that the accurate epochs cannot be obtained from the last column of Table 83. If we take the means of each couple of months, the probable error of each mean will be reduced to about a half (the probable error of the mean of December and January, = 0·024 inch, of January and February, = 0·019 inch, &c.), and the annual law will be more certain; these means are as follow:—

Prefix	Jan.—Feb.—March—April—May—June—July—Aug.—Sept.—Oct.—Nov.—Dec.—Jan.											
29 in.	·548	·568	·601	·666	·683	·643	·636	·685	·631	·527	·581	·600

These numbers give nearly the same result as that derivable from the simple means in the last column of Table 83. It is probable, therefore, that at Makerstoun the atmospheric pressure is a maximum from May to September, being rather less for the intermediate months than for the first and last of that period; that it is a minimum in the end of October and in the beginning of February, a secondary maximum occurring in the end of December.*

191. The quarterly groups which give the greatest range of mean pressure are the following,—

Jan. Feb. Mar.	April, May, June,	July, Aug. Sept.	Oct. Nov. Dec.	Oct.–Mar.	Apr.–Sept.
in.	in.	in.	in.	in.	in.
29·561	29·660	29·669	29·569	29·565	29·665

* Having examined the excellent series of barometric observations made under the direction of the Astronomer Royal at Greenwich, simultaneously with the Makerstoun series, for the purpose of comparing the annual law at the two places, the conclusions are given briefly in this note.

1*st*, From the means of 9 years' observations (1841–9) at Greenwich, the atmospheric pressure is a maximum from May to September, the secondary minimum seen between these months at Makerstoun being wholly wanting; it is also a maximum in December, and, unlike the Makerstoun result, the mean for December is the greatest; it is a minimum in October and November, as at Makerstoun; and it is a minimum again in April, about two months after the corresponding minimum for Makerstoun.

2*d*, When we compare the Greenwich monthly means for the 8 years 1842–9 with the Makerstoun monthly means for the same years, both being reduced to the level of the sea, and to 32° Fahrenheit, we find the barometer at Greenwich higher than at Makerstoun in each month, and for the whole period as follows:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0·167	0·133	0·097	0·031	0·014	0·087	0·114	0·097	0·035	0·112	0·140	0·146	0·098

Whence it appears that for the same (sea) level, the barometer, on the average of 8 years, is *one-tenth of an inch* lower at Makerstoun than at Greenwich, 4° 6′ farther south; and that this difference of pressure varies with the month. The excess of the atmospheric pressure at Greenwich over that at Makerstoun is a principal maximum in January, the *coldest* month; and it is a maximum again in July, the *hottest* month; it is a minimum in April and May, and again in September. It may be remarked, with reference to this curious result, that the positions of Greenwich and Makerstoun are much alike; nearly on the same meridian, and nearly equi-distant from the eastern coast of the island. There is no doubt that the greater proximity of Greenwich to the Continent has an effect upon its temperature, the mean temperature of Greenwich being only 2° higher than that of Makerstoun in winter, while it is 5° higher in summer.

3*d*, From the mean of 8 years the atmospheric pressure at Greenwich is 0·098 inch greater than at Makerstoun, but the excess is by no means constant for each year; the excesses for each year are,—

1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.
in.	in.	in.	in.	in.	in.	in.	in.
0·119	0·096	0·070	0·096	0·102	0·116	0·104	0·079

The excess varies as much as half its mean value, and appears, on the whole, greatest in the hottest years and least in the coldest.

4*th*, The following coincidences may be mentioned. The epochs of the annual law of mean atmospheric pressure (especially those for Greenwich) are nearly the same as for the annual law of magnetic declination (No. 9); and the law of differences of pressure for the two places has nearly the same epochs as the annual law for the magnetic force (No. 136).

The mean pressure for the six months October to March is 0·100 inch less than that for the six months April to September, while the range of the *quarterly* groups for the *meteorological* seasons is only 0·057 in. Neglecting therefore the minor variations, the law of atmospheric pressure is distinguished by a maximum for the six months during which the sun is north of the equator, and a minimum for the six months during which it is south of the equator. The means for the separate quarters show no direct connection with temperature, since April to June, and July to September have nearly the same mean pressure.

TABLE 84.—Mean Differences of the Daily Mean Atmospheric Pressure from the Monthly Mean, for each Month in the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1843	0·412	0·281	0·261	0·217	0·218	0·270	0·184	0·237	0·167	0·262	0·274	0·126	0·242
1844	·279	·274	·310	·192	·142	·127	·126	·216	·151	·304	·323	·224	·222
1845	·257	·145	·208	·323	·189	·258	·197	·214	·329	·250	·302	·313	·249
1846	·373	·255	·325	·301	·256	·273	·195	·176	·306	·337	·394	·327	·293
Mean	·330	·239	·276	·258	·201	·232	·175	·211	·238	·288	·324	·247	·252

192. *Annual Variation of the Differences of the Daily Mean from the Monthly Mean Pressure.*—From the means for four years in Table 84, the daily mean pressure of the atmosphere varied most in the months of November and January, and it varied least in July. The following groups give the greatest and least quarterly means,—

Nov. Dec. Jan.	Feb. Mar. April,	May, June, July,	Aug. Sept. Oct.
in.	in.	in.	in.
0·300	0·258	0·203	0·246

The daily mean height of the barometer differs on the average *three* tenths of an inch from the monthly mean in the winter quarter, Nov.–Jan., and only *two* tenths of an inch in the summer quarter.

TABLE 85.—Monthly Means of the Diurnal Ranges of the Atmospheric Pressure for the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1843	0·342	0·180	0·206	0·235	0·151	0·169	0·194	0·166	0·165	0·285	0·355	0·207	0·221
1844	·224	·282	·298	·185	·124	·148	·156	·181	·134	·234	·196	·145	·192
1845	·320	·243	·236	·222	·131	·184	·181	·164	·223	·208	·269	·452	·236
1846	·283	·202	·269	·160	·183	·142	·172	·149	·165	·294	·223	·217	·205
Mean	·292	·227	·252	·200	·147	·161	·176	·165	·172	·255	·261	·255	·214

193. *Annual Variation of the Diurnal Range of the Atmospheric Pressure.*—From the means of the diurnal ranges for each month in the four years 1843–6, the diurnal range is least in May, and it is greatest in January; the following groups give the greatest and least quarterly means,—

Nov. Dec. Jan.	Feb. Mar. April,	May, June, July,	Aug. Sept. Oct.
in.	in.	in.	in.
0·269	0·226	0·161	0 197

The monthly mean diurnal range does not vary greatly in the six months for which the sun is south of the equator, nor in the six months for which it is north of the equator; thus, the mean range for the six months October to March = 0·257 in., and for the six months April to September = 0·170 in. On the whole, the diurnal range varies inversely with the monthly mean pressure. See No. 197 where the ranges of the mean diurnal variations are considered.

TABLE 86.—Variations of the Diurnal Range of Atmospheric Pressure, with reference to the Moon's Age and Declination for the Years 1843–6.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	in.	in.	in.	in.	in.	d. d.	in.	in.	in.	in.	in.
14—16	+·012	−·032	−·063	−·027	−·027	27— 1	+·031	+·019	+·026	+·022	+·025
17—20	−·014	·000	+·049	·000	+·009	2— 5	+·010	+·022	−·006	+·004	+·008
21—24	−·034	+·017	+·069	+·030	+·021	6— 8	−·001	+·009	−·005	−·053	−·012
25—28	+·001	−·001	−·009	−·003	−·003	9—12	+·010	−·018	−·021	+·010	−·005
29— 1	+·030	+·024	+·005	+·005	+·016	13—15	−·032	−·026	+·019	+·009	−·008
2— 5	+·010	+·011	+·002	+·019	+·011	16—19	−·028	−·007	−·003	−·002	−·010
6— 9	+·001	+·026	−·011	+·008	+·008	20—22	+·015	−·015	−·033	−·005	−·010
10—13	−·007	−·044	−·045	−·033	−·032	23—26	−·003	+·016	+·026	+·019	+·015

194. *Variation of the Diurnal Range of Atmospheric Pressure with the Moon's Age.*—Investigations have been entered into by different meteorologists for the purpose of exhibiting the effect of the varying position of the moon upon the mean daily pressure of the atmosphere; their success has been on the whole very doubtful. In our latitudes it is not easy to extricate the laws of these variations on account of the magnitude of the irregular changes; it was for this reason that, after discussing the daily mean pressures for the year 1843 with reference to the lunar arguments, the discussion of the diurnal ranges was substituted for that of the daily means; as it was conceived that the variation of the diurnal range might be considerable (as in the case of the oceanic tides, &c.), though the variation of the mean should be nearly or altogether zero; such had been found to be the case for the magnetic declination. The results of these discussions for each year, and for the mean of four years, are given in the first part of Table 86. The results for the four years are wonderfully consistent, and that of the mean of the four years may be expressed thus.—The diurnal range of the barometer is a minimum near opposition, and it is a maximum about the beginning of the second quarter, and immediately after conjunction; perhaps the intermediate minimum near conjunction is accidental and might disappear in a larger series. The range of these mean numbers is very considerable, upwards of half-a-tenth of an inch, and it is probable that had the means for single days of the argument been given, the range would have been nearly twice as great. This result is wholly different from what we should have expected when comparing the oscillation of the atmosphere with that of the ocean, and it appears difficult to offer an explanation for it; we shall find however when we examine Table 91, that it is probably connected with the force of the wind; at least *that* obeys the same law, the diurnal range of the barometer being greatest when the force of the wind is greatest.

195. *Variation of the Diurnal Range of the Atmospheric Pressure with Reference to the Moon's Declination.*—The values for four years for this argument are given in the second part of Table 86; the results for each year agree here also to a remarkable extent with that shewn by the mean of the whole four years. The diurnal range of the barometer is a maximum when the moon is farthest north, it is a minimum when the moon is south of the equator. This result is also connected with that for the force of the wind (see No. 201), the diurnal range of the barometer being greatest when the force of the wind is greatest, and *vice versa*.

TABLE 87.—Diurnal Variation of the Atmospheric Pressure for each Astronomical Season and for the Year, deduced from the observations of the Years 1843–6.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.	in.	in.	in.	in.	in.	h. m.	in.	in.	in.	in.	in.
12 10	+·0026	+·0040	+·0040	+·0041	+·0037	0 10	+·0043	+·0051	+·0029	+·0008	+·0033
13 10	−·0041	−·0013	+·0010	+·0013	−·0008	1 10	−·0005	+·0011	+·0003	−·0036	−·0007
14 10	−·0055	−·0057	−·0028	−·0023	−·0041	2 10	−·0029	−·0038	−·0035	−·0073	−·0043
15 10	−·0108	−·0112	−·0047	−·0058	−·0081	3 10	−·0010	−·0062	−·0080	−·0106	−·0064
16 10	−·0159	−·0135	−·0025	−·0073	−·0098	4 10	+·0017	−·0059	−·0117	−·0113	−·0068
17 10	−·0179	−·0122	+·0016	−·0043	−·0082	5 10	+·0034	−·0030	−·0136	−·0097	−·0057
18 10	−·0158	−·0092	+·0049	+·0009	−·0048	6 10	+·0060	+·0013	−·0103	−·0047	−·0019
19 10	−·0096	−·0043	+·0075	+·0057	−·0002	7 10	+·0073	+·0078	−·0060	+·0004	+·0024
20 10	−·0012	+·0008	+·0091	+·0082	+·0042	8 10	+·0085	+·0108	−·0006	+·0051	+·0059
21 10	+·0060	+·0036	+·0082	+·0091	+·0067	9 10	+·0095	+·0107	+·0024	+·0068	+·0073
22 10	+·0122	+·0059	+·0071	+·0074	+·0081	10 10	+·0078	+·0092	+·0044	+·0072	+·0071
23 10	+·0098	+·0075	+·0056	+·0048	+·0069	11 10	+·0066	+·0075	+·0051	+·0060	+·0063

Table 87 has been formed thus :—The hourly means for each quarter were obtained for each year ; those for 1844 and 1845 were corrected for continuous barometric change as described in the volume for 1844, p. 422, excepting that the change of pressure from 11^h to 12^h, was considered equal to the mean of the changes from 10^h to 11^h and from 12^h to 1^h, (instead of from 10^h to 11^h only) : the hourly means for each quarter were then combined in the manner already described for the magnetic declination, No. 26.

TABLE 88.—Daily Epochs of Maximum and Minimum Atmospheric Pressure, with the Intervals from Epoch to Epoch, for each Quarter, and for the Year.

Period.	Minimum A. M.	Interval from Min. to Max.	Maximum A. M.	Interval from Max. to Min.	Minimum P. M.	Interval from Min. to Max.	Maximum P. M.	Interval from Max. to Min.	Mean Epoch betwixt the Two	
									Maxima.	Minima.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Nov. Dec. Jan.	5 15	5 10	10 25	3 40	2 5	6 55	9 0	8 15	3 42	9 40
Feb. Mar. Apr.	4 5	7 0	11 5	4 15	3 20	5 10	8 30	7 35	3 47	9 42
May June July	3 15	4 55	8 10	8 45	4 55	6 5	11 0	4 15	3 35	10 5
Aug. Sept. Oct.	4 15	4 45	9 0	6 50	3 50	6 10	10 0	6 15	3 30	10 2
Year	4 10	6 10	10 20	5 30	3 50	5 40	9 30	6 40	3 55	10 0

196. *Diurnal Variation of the Atmospheric Pressure.*—From Table 87, this consists of two maxima and two minima in each quarter of the year : the approximate epochs in apparent time, as deduced from the projections of Table 87 (see Plate IX.), are given in Table 88.

1*st*, The principal maximum occurs in the evening in spring, and in the forenoon in the other quarters : the principal minimum occurs in the morning in winter and spring, and in the afternoon in summer and autumn.

2*d*, The morning minimum occurs earliest in summer and latest in winter, obeying something like the law of sunrise, though the difference of epochs is variable, the minimum occurring about 3 hours before sunrise in winter, and immediately before sunrise in summer : the epoch of minimum temperature had a nearly similar relation to that of sunrise, but the similarity of the relations of the two classes of facts is more apparent than real, since the temperature of the air varies little in winter from 6^h P.M. till 8^h A.M.

3*d*, The morning maximum occurs latest in spring and earliest in summer, the difference of the epochs for the two seasons being nearly three hours.

4*th*, The afternoon minimum occurs earliest in winter and latest in summer, the difference of the epochs being nearly three hours. The epochs of this minimum have some relation to those for sunset as the morning minimum epochs had to sunrise, thus :—In winter, the morning minimum occurs about three hours before sunrise, in summer the afternoon minimum occurs about three hours before sunset; in winter the afternoon minimum occurs about one hour and a half before sunset, in summer the morning minimum occurs about half-an-hour before sunrise.

5*th*, The afternoon maximum occurs latest in summer and earliest in spring; the difference of the epochs is two and a half hours.

6*th*, It is not easy to relate the variations of the epochs of the maxima to those of any other facts; it is to be observed, however, that the morning maximum occurs nearest noon in spring and farthest from noon in summer, while the afternoon maximum occurs farthest from midnight in spring and nearest midnight in summer.

TABLE 89.—Whole Amount and Hourly Rate of the Change of Atmospheric Pressure from Epoch to Epoch in the Diurnal Variation for each Quarter, and for the Year.

Period.	A. M. Minimum to A. M. Maximum.		A. M. Maximum to P. M. Minimum.		P. M. Minimum to P. M. Maximum.		P. M. Maximum to A. M. Minimum.		Whole Oscillations.	
	Total.	Per Hour.	Total.	Per Hour.	Total.	Per Hour.	Total.	Per Hour.	Sum.	Per Hour.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Nov. Dec. Jan.	0·0308	0·0060	0·0160	0·0044	0·0126	0·0018	0·0275	0·0033	0·0869	0·0036
Feb. Mar. Apr.	·0210	·0030	·0140	·0033	·0180	·0035	·0250	·0033	·0780	·0033
May June July	·0139	·0018	·0230	·0026	·0191	·0031	·0100	·0024	·0660	·0027
Aug. Sept. Oct.	·0166	·0035	·0208	·0030	·0188	·0031	·0146	·0023	·0708	·0030
Year	·0180	·0029	·0150	·0027	·0145	·0026	·0173	·0026	·0648	·0027

197. The total oscillations from one turning point to the next are given in Table 89, with the hourly rate of change; from these, we find that the change of pressure, from the morning minimum to the morning maximum, is greatest in winter and least in summer; from the afternoon minimum to the evening maximum, it is least in winter and greatest in summer; from the morning maximum to the afternoon minimum, it is least in spring and greatest in summer; from the evening maximum to the morning minimum, it is greatest in winter and least in summer. On the whole, when we compare the diurnal variations with respect to season, both as to the epochs and relative amounts of the oscillations, from turning point to turning point, we arrive at the following conclusion :—1*st*, That the law of diurnal variation of atmospheric pressure at Makerstoun, is almost precisely the same in winter as it is in summer, *if we substitute noon for midnight, and* P.M. *for* A.M. *in the former.** 2*d*, As the diurnal variation for spring is analogous to that for winter, and the diurnal variation for autumn is similar to that for summer, the same law of opposition holds for spring and autumn as for summer and winter. See Plate IX.

3*d*, The whole diurnal oscillation is greatest in winter, and it is least in summer.

PRESSURE OF THE WIND.

198. In the volumes for the years 1843 and 1844, both the maximum pressures of the wind occurring *betwixt* the hours of observations and the observed pressures within 7^m to 10^m *at* the hours of observation were discussed; as both discussions gave the same results, and as the latter make an approximation to the actual continuous mean pressures, only the means of the pressures occurring within 7^m to 10^m *at* the hours of observation will be considered here.

* This curious fact, it seems to me, is wholly opposed to what may be termed the temperature theory of the regular diurnal variation of atmospheric pressure; the best marked barometric oscillation at Makerstoun occurs while the temperature and pressure of aqueous vapour are nearly constant, namely, in winter between 6^h P.M. and 9^h A.M.

TABLE 90.—Monthly Means of the Maximum Pressure of the Wind within 10^m at the Observation Hours for the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1843	1·29	0·87	0·32	0·49	0·39	0·40	0·35	0·17	0·16	0·42	0·48	0·72	0·50
1844	0·34	0·37	0·52	0·41	0·20	0·50	0·16	0·37	0·34	0·57	0·63	0·09	0·37
1845	0·45	0·52	0·81	0·61	0·67	0·56	0·39	0·38	0·28	0·63	0 51	0·97	0·56
1846	0·48	0·47	0·61	0·35	0·54	0·36	0·49	0·19	0·18	0·42	0·46	0·36	0·41
Mean	0·64	0·56	0·56	0·46	0·45	0·45	0·35	0·28	0·24	0·51	0·52	0·53	0·46

199. *Annual Variation of the Approximate Mean Pressures of the Wind.*—From the means of 4 years' observations, the wind blew with the greatest mean force in January, and with the least mean force in September. The mean pressure, however, varies little for the six months October to March, while the sun is south of the equator; it is nearly constant for the three months, April, May, and June, diminishing gradually from June to September. September is the month of least pressure in each year, excepting 1844; the month of maximum pressure is more variable, January in 1843, November in 1844, December in 1845, and March in 1846.

TABLE 91.—Variations of the Pressure of the Wind with reference to the Moon's Age and Declination for the Years 1843–6.

Moon's Age.	1843.	1844.	1845.	1846.	Mean.	After Moon farthest North.	1843.	1844.	1845.	1846.	Mean.
d. d.	lb.	lb.	lb.	lb.	lb.	d. d.	lb.	lb.	lb.	lb.	lb.
14—16	+0·03	−0·16	−0·09	−0·08	−0·07	27— 1	−0·06	+0·32	+0·06	+0·05	+0·09
17—20	−0·18	+0·04	+0·17	+0·03	+0·02	2— 5	−0·11	−0·01	+0·02	−0·04	−0·03
21—24	−0·06	+0·18	−0·01	−0·03	+0·02	6— 8	−0·01	−0·02	−0·10	−0·01	−0·03
25—28	+0·05	+0·10	+0·05	−0·10	+0·02	9—12	+0·02	−0·07	−0·06	+0·08	−0·01
29— 1	+0·20	0·00	+0·17	+0·07	+0·11	13—15	+0·08	−0·17	+0·04	−0·03	−0·02
2— 5	+0·07	−0·08	−0·03	+0·13	+0·02	16—19	+0·12	−0·04	+0·04	−0·12	0·00
6— 9	−0·04	+0·04	−0·07	−0·01	−0·02	20—22	+0·05	−0·10	−0·15	+0·03	−0·04
10—13	−0·08	−0·15	−0·15	−0·01	−0·10	23—26	−0·09	+0·07	+0·16	+0·07	+0·05

200. *Approximate Mean Pressure of Wind with Reference to the Moon's Age.*—The mean result from the first portion of Table 91 shews, *that the pressure of the wind was a maximum at conjunction and a minimum near opposition.* The result for each year shews a well-marked minimum near opposition, and a maximum near conjunction. It has already been noticed (No. 194), that the diurnal range of the atmospheric pressure obeys a similar law; that is to say, for this argument, the diurnal oscillation of the statical pressure of the atmosphere is a maximum when its dynamical pressure is a maximum.

201. *Approximate Mean Pressure of the Wind with Reference to the Moon's Declination.*—From the last column of Table 91, the mean result of 4 years' observations, it appears *that the pressure of the wind is a maximum when the moon is farthest north.* This result is shewn with some distinctness in each year, excepting in 1843, for which the maximum occurs when the moon is farthest south; there is, however, the appearance of a maximum near the time of the moon's farthest southerly position in the years 1845 and 1846; and, indeed, in the mean for the 4 years; it is probable therefore that the minimum pressure of the wind occurs when the moon is near the equator. The same relation, between the diurnal oscillation of the statical pressure of the atmosphere and its dynamical pressure, holds as in No. 200.

TABLE 92.—Diurnal Variation of the Maximum Pressure of the Wind within 10^m at the Observation Hours, for each Astronomical Season and for the Year, deduced from the Observations of the Years 1843–6.

Mak. Mean Time.		Nov., Dec., Jan.	Feb., March, April.	May, June, July.	August, Sept., Oct.	Year.	Mak. Mean Time.		Nov., Dec., Jan.	Feb., March, April.	May, June, July.	August, Sept., Oct.	Year.
h.	m.	lb.	lb.	lb.	lb.	lb.	h.	m.	lb.	lb.	lb.	lb.	lb.
12	10	−0·07	−0·21	−0·20	−0·12	−0·15	0	10	+0·13	+0·25	+0·23	+0·17	+0·19
13	10	−0·10	−0·15	−0·19	−0·08	−0·13	1	10	+0·11	+0·29	+0·27	+0·22	+0·22
14	10	−0·13	−0·14	−0·21	−0·09	−0·14	2	10	+0·06	+0·32	+0·28	+0·19	+0·21
15	10	−0·03	−0·08	−0·22	−0·10	−0·11	3	10	+0·02	+0·26	+0·25	+0·14	+0·17
16	10	−0·05	−0·10	−0·18	−0·10	−0·11	4	10	−0·03	+0·14	+0·18	+0·11	+0·10
17	10	−0·02	−0·12	−0·15	−0·09	−0·09	5	10	+0·02	+0·03	+0·14	+0·02	+0·05
18	10	−0·05	−0·08	−0·11	−0·09	−0·08	6	10	−0·03	−0·05	+0·03	−0·05	−0·02
19	10	−0·05	−0·10	−0·03	−0·10	−0·07	7	10	−0·01	−0·15	−0·06	−0·07	−0·07
20	10	−0·03	+0·03	+0·13	−0·04	+0·02	8	10	+0·02	−0·19	−0·13	−0·10	−0·10
21	10	+0·04	+0·11	+0·17	+0·07	+0·10	9	10	−0·02	−0·14	−0·19	−0·10	−0·11
22	10	+0·07	+0·21	+0·19	+0·15	+0·15	10	10	+0·02	−0·16	−0·21	−0·13	−0·12
23	10	+0·11	+0·24	+0·23	+0·20	+0·19	11	10	0·00	−0·21	−0·19	−0·08	−0·12

202. *Diurnal Variation of the Mean Pressure of the Wind.*—It is evident from the means in Table 92, that 4 years' observations are too few to destroy the irregularities produced by the large atmospheric disturbances; the following, however, are the approximate epochs of maximum and minimum :—

		Minimum.	Mean.	Maximum.	Mean.
Winter,	Nov., Dec., Jan.,	$2^h\ 10^m$ A.M.	$8^h\ 36^m$ A.M.	$0^h\ 10^m$ P.M.	3^h P.M.—11^h P.M.
Spring,	Feb., March, April,	$11^h\ 40^m$ P.M.	$7^h\ 56^m$ A.M.	$1^h\ 55^m$ P.M.	$5^h\ 32^m$ P.M.
Summer,	May, June, July,	9^h P.M.—4^h A.M.	$7^h\ 21^m$ A.M.	$1^h\ 45^m$ P.M.	$6^h\ 30^m$ P.M.
Autumn,	Aug., Sept., Oct.,	8^h P.M.—7^h A.M.	$8^h\ 32^m$ A.M.	$1^h\ 0^m$ P.M.	$5^h\ 27^m$ P.M.
	Year,	1^h A.M.	$7^h\ 57^m$ A.M.	$1^h\ 30^m$ P.M.	$5^h\ 53^m$ P.M.

It will be seen that the variation of the pressure of the wind obeys a law analogous to that of the variation of temperature, while the sun is above the horizon; it follows the ascent and descent of the sun, however, more closely than the temperature: thus, in winter the mean pressure of the wind occurs almost exactly at sunrise and at sunset, and the maximum occurs immediately after mid-day, in all instances anticipating the corresponding epochs for the temperature by an hour or more. A similar difference is observable in each quarter; this will be seen most satisfactorily in Plate IX., where the dotted curves of wind pressure are projected on the same mean or zero lines; as the curves for the temperature of the air: while the day portions of the curves are evidently connected with each other, this is not the case during the night; the minimum pressure of wind has upon the whole the same relation to midnight that the maximum has to mid-day. In winter the pressure varies irregularly from hour to hour during the night; in summer and autumn the pressure is nearly constant for some hours before and after midnight. When we consider the mean for the year, we find the ordinates of equal value in the day portion of the curve at times equidistant from 1^h P.M., and in the night portion of the curve, from 1^h A.M.: the pressure of the wind, therefore, is related more directly to the position of the sun than to the temperature of the place, especially during the night.

The range of the mean diurnal variation is least in winter, and it is greatest in spring and summer—the ranges are—

Winter = 0·26 lb. Spring 0·53 lb. Summer 0·50 lb. Autumn 0·35 lb. Year 0·37 lb.

TABLE 93.—Number of Observation Hours in 24 at which (within 10m) the Wind blew with a force of 0·1 lb. or upwards, for each Month in the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1843	18·0	16·2	11·6	12·9	15·3	17·7	14·7	9·3	10·2	15·5	12·4	16·8	14·2
1844	8·6	12·3	14·7	14·3	10·2	16·0	11·3	16·1	17·7	17·0	17·7	6·8	13·6
1845	14·4	18·7	20·3	16·2	20·7	18·3	17·8	18·2	15·8	21·1	15·2	19·6	18·0
1846	15·9	16·8	14·6	17·2	19·5	15·7	21·0	17·8	17·5	18·8	17·7	17·7	17·5
Mean	14·2	16·0	15·3	15·1	16·4	16·9	16·2	15·3	15·3	18·1	15·7	15·2	15·8

203. *Annual Variation of the Number of Observation Hours at which the Wind was observed to blow with a force of* 0·1 *lb. or upwards.*—Four years' observations are evidently insufficient to shew this annual variation free from irregularity. The wind blew during the greatest number of hours in October and in June, and it blew during the least number of hours in January. See Table 93.

TABLE 94.—Mean Pressure of the Wind while blowing, for each Month in the Years 1843–6.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1843	1·66	1·27	0·65	0·89	0·62	0·55	0·56	0·45	0·38	0·58	0·92	1·00	0·79
1844	0·96	0·73	0·85	0·69	0·46	0·75	0·33	0·56	0·46	0·80	0·86	0·33	0·65
1845	0·76	0·66	0·95	0·91	0·77	0·73	0·53	0·50	0·43	0·72	0·80	1·19	0·75
1846	0·70	0·67	0·99	0·48	0·67	0·56	0·56	0·26	0·25	0·55	0·63	0·49	0·57
Mean	1·02	0·84	0·86	0·74	0·65	0·65	0·50	0·44	0·38	0·66	0·80	0·75	0·69

204. *Annual Variation of the Mean Pressure of the Wind while blowing.*—We have in No. 199 considered the annual variation of the mean pressure of the wind with reference to time, the sums of the observed pressures being divided by the whole number of observations; in the present case the sums of the observed pressures are divided only by the number of observations for which the wind was blowing: thus, in November 1843, the wind was observed blowing at little more than half the whole number of observation hours; consequently the mean pressure with reference to the whole number of observations for that month (Table 90) is only a half of the mean pressure with which the wind was observed blowing (Table 94). The law is the same for both means, but it is better marked in the present case than in that of No. 199. *The wind blows with the greatest force in January, and with the least force in September.*

205. *Diurnal Variation of the Number of Observation Hours at which the Wind was observed blowing.*—The following are the mean numbers of times, at which the wind was observed blowing 0·1 lb. or upwards, in the four years 1843–6 :—

12h	1h A.M.	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	0h	1h P.M.	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h
150	156	155	164	162	163	176	190	214	224	242	251	262	266	266	258	249	240	225	211	186	169	162	160

The wind blew most frequently at 1h 40m P.M., the epoch of maximum temperature; it blew seldomest about 1h A.M.

206. *Diurnal Variation of the Mean Pressure of the Wind while blowing* (see No. 204). The following are the means for each hour, as deduced from the observations for the four years 1843–6 :—

12h	1h A.M.	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	0h	1h P.M.	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
0·67	0·67	0·65	0·69	0·70	0·71	0·67	0·64	0·70	0·77	0·78	0·80	0·78	0·80	0·80	0·75	0·70	0·67	0·61	0·58	0·61	0·65	0·67	0·69

These numbers still present several irregularities; on the whole, however, the wind blows with the greatest force about 1^h P.M., and with the least force about 7^h P.M., or about an hour after noon and an hour after sunset respectively; another minimum of force occurs at 7^h A.M., an hour after sunrise, and a secondary maximum occurs between 11^h P.M. and 5^h A.M., the exact epoch is not deducible from these means; the means for 1844 and 1845 only, place it near midnight.

207. *Yearly Mean Value and Direction of the Resultant Wind.*—From the last line of Table 95, it appears that the direction of the resultant wind was nearly constant in each of the three years, 1843, 1844, and 1845.—1846 appears to have been quite anomalous; in each of the former years there are eight or nine months in which the resultant wind blows from between west and south, for only two or three of these months is the resultant nearer south than west; but in 1846 there are ten months, for which the resultant wind blows from between south and west, and for eight of these it is nearer south than west.

If we neglect the year 1846, the winds at Makerstoun are equivalent to one continuous wind blowing from nearly WSW. with a force approximately of about two-tenths of a pound on a square foot of surface.

TABLE 95.—Values and Directions of the Resultant Winds, with the Sums of the Pressures of the Wind resolved into the four Cardinal Points of the Compass, for each Month of the Years 1843–6.

Month.	1843.		1844.		1845.		1846.		1843–6.				1843–6.	
	Resultant.		Resultant.		Resultant.		Resultant.		Sums of Pressures observed at the 24 Observation Hours for 100 Days in each Month, resolved into				Resultant.	
	Mean.	Direction.	Mean.	Direction.	Mean.	Direction.	Mean.	Direction.	N.	E.	S.	W.	Mean.	Direction.
	lb.	°	lb.	°	lb.	°	lb.	°	lb.	lb.	lb.	lb.	lb.	°
Jan.	0·93	W. 17 S.	0·27	W. 8 S.	0·36	S. 29 W.	0·37	S. 43 W.	172	45	700	933	0·43	W. 29·5 S.
Feb.	0·43	N. 8 W.	0·14	W. 37 N.	0·22	W. 9 S.	0·38	W. 34 S.	534	161	408	565	0·18	W. 17·3 N.
Mar.	0·04	S. 31 E.	0·20	W. 5 N.	0·39	W. 2 S.	0·52	S. 38 W.	332	153	580	667	0·24	W. 26·3 S.
April	0·26	W. 23 S.	0·35	W. 32 S.	0·15	N. 7 E.	0·21	N. 24 E.	423	174	406	423	0·10	W. 3·9 N.
May	0·20	E. 4 N.	0·16	N. 24 E.	0·28	N. 11 E.	0·32	S. 44 W.	446	377	313	317	0·06	N. 24·2 E.
June	0·12	N. 4 E.	0·34	W. 30 S.	0·34	S. 44 W.	0·30	S. 39 W.	223	133	540	549	0·22	W. 37·4 S.
July	0·29	W. 37 S.	0·06	W. 4 N.	0·13	W. 43 S.	0·38	S. 44 W.	140	88	445	451	0·20	W. 40·0 S.
Aug.	0·18	S. 26 W.	0·18	W. 15 S.	0·16	W. 29 N.	0·07	S. 30 W.	186	79	292	332	0·11	W. 22·7 S.
Sept.	0·06	W. 24 N.	0·07	W. 33 S.	0·15	W. 29 S.	0·05	S. 34 W.	161	111	238	267	0·07	W. 26·1 S.
Oct.	0·19	W. 1 S.	0·23	S. 43 W.	0·45	W. 34 S.	0·08	W. 35 S.	249	156	543	613	0·23	W. 32·8 S.
Nov.	0·33	W. 24 S.	0·14	S. 23 E.	0·44	S. 32 W.	0·28	S. 15 W.	176	192	705	505	0·26	S. 30·7 W.
Dec.	0·69	W. 40 S.	0·06	E. 30 S.	0·69	W. 16 S.	0·24	N. 40 W.	262	42	546	790	0·33	W. 20·8 S.
Year	0·20	W. 21 S.	0·13	W. 21 S.	0·23	W. 23 S.	0·19	W. 41 S.	274	143	477	535	0·18	W. 27·3 S.

208. *Annual Variation of the Force and Direction of the Resultant Winds.*—The details of these discussions will be found in pages 64 and 84 of this volume, p. 295, 1843, and p. 434, 1844. From Table 95, it appears that—

1*st*, The sums of pressures of the northerly winds are greatest in the months of February, March, April, and May; they are least in the months of July, August, September, and November.

2*d*, The sums of pressures of the easterly winds are twice a maximum and twice a minimum in the year; they are a principal maximum in May, and a secondary maximum in November; they are a minimum in July and August, and in December and January.

3*d*, The sums of pressures of the southerly winds are greatest in November and January, and they are least in September.

4*th*, The sums of pressures of the westerly winds are greatest in December and January, and they are least in September.

5*th*, When we examine the approximate mean forces of the resultant wind for each month, we find that on the whole they exhibit two maxima and two minima in the course of the year. The resultant wind is a principal maximum in January, and a secondary maximum in June and July; it is a minimum in May and in September.

6*th*, The direction of the resultant wind is from 17° north of west in February, from 4° north of west in April, from 24° east of north in May, and from between west and south in the remaining nine months of the year.

Of the nine months in which the resultant wind is from between west and south, there are eight, for which it occurs between W. 20° S., and W. 40° S., or nearly between WSW. and SW.; in November the resultant wind is most southerly, coming from W. 59° S. nearly SW by S.

209. If we compare the mean of the pressures observed in all directions (last line of Table 90), in each month, with the resultant mean pressure of the wind, the ratio will evidently give some measure of the variability of the wind; where, by variability is meant the amount of opposedness of the masses of air in motion during the period considered, without relation to the frequency of the oppositions; the ratios are for each month as follow:—

Jan.	Feb.	Mar.	April,	May,	June,	July,	Aug.	Sep.	Oct.	Nov.	Dec.
1·5	3·1	2·3	4·6	7·5	2·0	1·7	2·5	3·4	2·2	2·0	1·6

Of the whole amount of air in motion during each month, the greatest proportions proceed from one quadrant or direction in December and January, the coldest period of the year, and also in July, the hottest month of the year; the winds are most equally distributed in all the quadrants in the months of April and May; a secondary maximum of variability occurring again in September.

210. *Diurnal Variation of the Resultant Mean Pressure of the Wind.*—The following are the values of the resultant mean pressure for each hour, as deduced from the observations for the years 1843–6:—

12^h	1^h A.M.	2^h	3^h	4^h	5^h	6^h	7^h	8^h	9^h	10^h	11^h	0^h	1^h P.M.	2^h	3^h	4^h	5^h	6^h	7^h	8^h	9^h	10^h	11^h
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
0·15	0·15	0·16	0·17	0·17	0·17	0·16	0·16	0·21	0·23	0·25	0·25	0·25	0·27	0·24	0·21	0·19	0·18	0·15	0·15	0·15	0·15	0·15	0·16

From these means the maximum occurs before 1^h P.M., and the minimum occurs between 6^h P.M. and 1^h A.M.

211. *Diurnal Variation of the Direction of the Resultant Wind.*—It was first pointed out in the volume of Makerstoun Observations for 1843, p. 300, that the direction of the resultant wind had a diurnal variation, being more towards the south of west in the morning and evening than about mid-day; this result was confirmed with great distinctness in the discussion of the Observations for 1844 (vol. 1844, p. 438, and Plate XVI.); an equally distinct result has been obtained from the observations for 1845 (p. 64 of this volume); this has not been the case with the observations for 1846, a year which, when compared with the others, was anomalous in all its resultant directions (see No. 207). The following Table contains the means of the resultant directions of each month for the years 1844 and 1845, and for the four years 1843–6, each year receiving an equal value, and the means for the four years being obtained, as described No. 26.

TABLE 96.—Diurnal Variation of the Direction of the Resultant Wind.

Mak. Mean Time.	Mean of 1844–5.	Mean of 1843–6.	Mak. Mean Time.	Mean of 1844–5.	Mean of 1843–6.
h.	°	°	h.		
12	W. 30 S.	W. 28 S.	0	W. 15 S.	W. 25 S.
13	W. 36 S.	W. 35 S.	1	W. 12 S.	W. 24 S.
14	W. 34 S.	W. 34 S.	2	W. 9 S.	W. 19 S.
15	W. 31 S.	W. 32 S.	3	W. 8 S.	W. 17 S.
16	W. 35 S.	W. 36 S.	4	W. 16 S.	W. 23 S.
17	W. 31 S.	W. 33 S.	5	W. 21 S.	W. 26 S.
18	W. 30 S.	W. 30 S.	6	W. 22 S.	W. 25 S.
19	W. 28 S.	W. 27 S.	7	W. 25 S.	W. 27 S.
20	W. 18 S.	W. 22 S.	8	W. 39 S.	W. 39 S.
21	W. 13 S.	W. 23 S.	9	W. 38 S.	W. 35 S.
22	W. 10 S.	W. 19 S.	10	W. 38 S.	W. 35 S.
23	W. 11 S.	W. 20 S.	11	W. 30 S.	W. 28 S.

The range of the variation for the four years 1843–6 is somewhat diminished by the anomalous numbers for 1846; but both series agree in shewing the resultant wind to be most westerly about 3^h P.M., and most southerly between 8^h P.M. and 4^h A.M.

212. The following numbers are the ratios for each second hour of the hourly mean pressures observed in all directions (obtained from the year-column of Table 92, by the addition of 0·46, the mean pressure for the 4 years), to the resultant mean pressures, No 210.

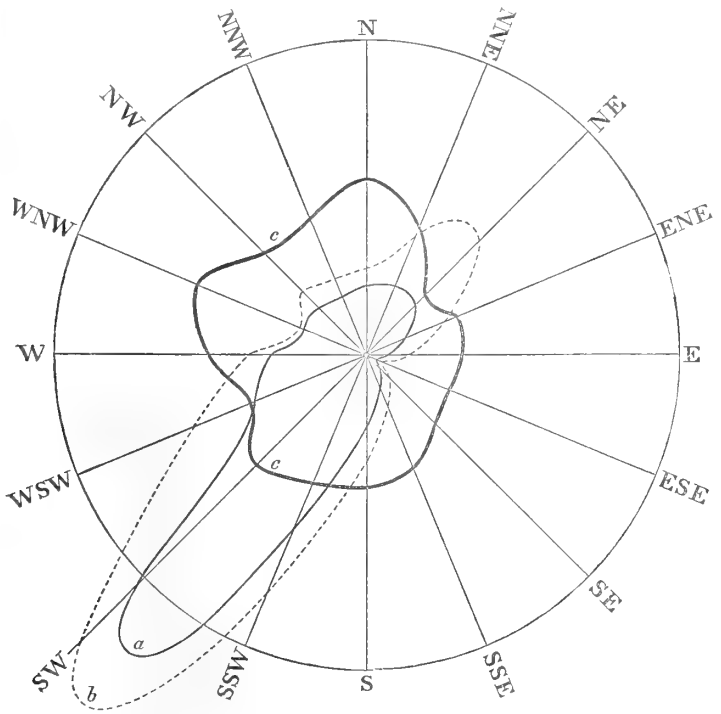
12h	2h A.M.	4h	6h	8h	10h	0h	2h P.M.	4h	6h	8h	10h
2·1	2·1	2·1	2·3	2·3	2·4	2·6	2·8	2·9	2·8	2·4	2·2

We may conclude, as in No. 209, that of the total mass of air in motion at each hour, the greatest proportion was from the *same* quadrant or direction at 2h A.M., and the greatest proportion was from *opposite* directions at 4h P.M.

213. *Times which the Wind blew from the* 16 *Principal Points of the Compass.*—The times which the wind was observed blowing from *each* point of the compass, at the observation hours, are given for each year in the previous and in the present volume; for 1843 and 1846 the sums for 12 two-hourly observations are given, having doubled these to make them comparable with the means from the hourly observations of 1844 and 1845, the sums for four years for each point were obtained: the sums for each of the 16 principal points were then formed in this manner;—the sum of the times in the north was made equal to half the sum of the times in N by W., *plus* half the sum of the times in N by E., *plus* the sum of the times observed in N.; and similarly for each of the other 16 points.* The sums thus obtained from the four years' observations are as follow:—

N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
779	1318	1668	867	431	177	329	575	1088	2672	4212	1949	1198	726	932	866

The wind blew most frequently with a pressure of 0·1 lb., or upwards, from a few degrees south of SW., the number of times diminishes rapidly to WNW., increases slightly in NW., diminishes from thence to N., it then increases considerably to a few degrees north of NE., where the secondary maximum occurs almost diametrically opposite to the principal maximum of frequency; from NE. the frequency diminishes to a few degrees south of ESE., where it is a principal minimum, a secondary minimum occurring in the opposite point; from ENE. the number increases rapidly to the maximum at SW. See curve *b* in the figure.



Radial scales. *a*, 1 inch = 2000 lbs. *b*, 1 inch = 2000 times. *c*, 1 inch = 1 lb.

* The combination into the 16 principal points was rendered necessary by the fact, that in observing the direction of the wind from an oscillating vane-index, there is a tendency in all cases of doubt to prefer the principal to the secondary point, for which reason the numbers of observations for each of the 16 principal points were always greater than for either of the two adjacent points.

214. *Sums of the Pressures with which the Wind blew from each of the* 16 *Principal Points of the Compass.*—Following the same procedure as in No. 213, we obtain the following sums of pressure from four years' observations, of 24 a-day, the sums being of the maximum pressures observed within 10^m at the hours of observation. (See No. 198.)

N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
711	757	722	442	217	84	163	362	749	1945	3411	1262	990	693	689	654

The sums of pressures obey nearly the same laws as the frequency with which the wind blew; the greatest sum of pressures occurred a few degrees south of SW.; the sum then diminishes to W., varies little from WNW. to N. being, on the whole, less at NNW. than for the adjacent points; it becomes a secondary maximum about NE. by N., a principal minimum at ESE. (See curve *a* in the figure, p. ci.)

215. *Mean Pressure with which the Wind blew from each of the* 16 *Principal Points of the Compass.*—Dividing the sums of pressures for each of these points (No. 214) by the number of observations for which the wind was observed blowing at 0·1 lb., or upwards (No. 213), we obtain the following mean pressures with which the wind blew from each of the 16 points:—

N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.
lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
0·91	0·57	0·43	0·51	0·50	0·47	0·50	0·63	0·69	0·73	0·81	0·65	0·82	0·95	0·74	0·75

The wind blew with the greatest force from WNW. and N., and with the least force from NE. and ESE., but the mean force was nearly constant between NE. and SE. The mean force with which the wind blew between NNE. and SSE. = 0·52 lb., between NNW. and SSW. = 0·78 lb., or in the ratio of 2 to 3. When the projection of the previous values upon the directional radii are connected, a very symmetrical figure is formed, having three minima at intervals of about 80°, namely, at NE., NW by N., and WSW. (See curve *c* in the figure, p. ci.)

MOTIONS OF DIFFERENT CURRENTS OF AIR.

216. *Difference of the Directions of Motion of the Upper and Lower Currents of Air.*—The mode in which the directions of motion of the clouds were observed is described in the introductions to the previous volumes in the section, "State of the Sky." The process by which the results for the differences of motion of the different currents were obtained by the combination of simultaneous observations, will be found stated in the volume for 1844, p. 440. The detailed results for each of the four years 1843–6 are given in separate tables in the present and in the previous volumes. The total number of comparisons of the currents of scud, cirro-stratus, and cirrus, with the surface-current, and of the cirro-stratous and cirrous-currents with the scud-current, was in 1843, 865; the numbers of results (each of from five to two comparisons) were in 1844, 995; in 1845, 964; and in 1846, 541. In the discussion for 1843 only one or two simultaneous observations were termed a comparison; from five to two simultaneous observations were termed a result for the three following years (see 1844, p. 440); but as the values of the final results for each year were not considered greatly different, the numbers of comparisons of 1843, diminished by a tenth, have received the weight of the results in the following years, and the numbers of results for 1846 were increased by a half in the combinations given below. The weights of the four years 1843, 1844, 1845, and 1846, were taken on the whole, therefore, as 779 : 995 : 964 : 811.

217. The scud-current includes the cumulus; the cirro-stratous current includes also the cloud termed in the Makerstoun Observations the cirro-cumulo-stratus: this cloud, so frequently seen, has received no name in Mr HOWARD'S classification; it belongs to the region of the cirro-strati, and is composed of great numbers of clouds like small cirro-strati, arranged with a cirro-cumulous disposition. After this name had been applied to this cloud for some time, I discovered that Mr HOWARD had given it already to the Nimbus. The cirrous current includes the cirro-cumulus. The order of reckoning being from north, by the east, south, and west, one current is considered positive of another when it proceeds from a point more southerly in the eastern semi-circle and more northerly in the western semi-circle.

218. When we consider the results for each quadrant, we find they present differences, both in the values and signs of the mean differences of the directions of motion; in three of the quadrants, however, namely E to S., S to W., and W to N., the signs are the same; in every case the mean upper currents proceed from points positive of the currents below them. In the quadrant S to W. by far the greatest number of results have been obtained, and they are by far the most regular and distinct. Thus, in 774 results, each obtained from several comparisons of the current of scud with the surface-wind, 664 shewed the scud-current to proceed from a point

24° more northerly than the surface wind; while there were only 58 results shewing a more southerly motion, and 19 in which both currents proceeded from the same point. It might be supposed that the regular difference of these currents was due to some peculiar configuration of the surface of the country around the Observatory, but this is disproved by the results of the comparison of the upper currents with each other; thus, the cirro-stratous current, compared with the scud-current, shews on the average of 255 results that the upper current proceeds from a point 14° more northerly than the lower current: a similar result is obtained from a comparison of the cirrous current with the scud-current.

TABLE 97.—Differences of the Directions of Motions of the Lower and Upper Currents of Air, as deduced from the Comparisons of the Direction of the Wind, and the Motions of the Clouds, for the Years 1843–6.

Currents.	Quadrant N. to E.			Quadrant E. to S.			Quadrant S. to W.			Quadrant W. to N.		
	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.
		°	°		°	°		°	°		°	°
Scud *minus* Wind.	227	+23		76	+24		664	+24		166	+20	
	111	−25	+7	20	−23	+13	58	−13	+20	57	−18	+ 9
	12	0		9	0		19	0		15	0	
Cir.-str. *minus* Wind.	64	+40		46	+31		371	+40		113	+27	
	46	−51	+2	11	−25	+20	43	−19	+33	38	−35	+11
	3	0		1	0		12	0		6	0	
Cir.-str. *minus* Scud.	50	+36		41	+21		190	+27		107	+26	
	52	−37	−1	11	−26	+ 9	61	−18	+14	79	−33	+ 1
	16	0		15	0		34	0		27	0	
Cirrus *minus* Wind.	20	+58		15	+60		190	+45		51	+31	
	16	−59	+6	0	...	+57	26	−23	+36	13	−41	+15
	0	0		1	0		10	0		7	0	
Cirrus *minus* Scud.	20	+35		18	+54		107	+36		81	+27	
	17	−45	−2	2	−84	+38	33	−26	+20	33	−41	+ 7
	2	0		1	0		12	0		13	0	

219. It happens frequently that comparisons of the motions of two currents are obtained when the others do not exist, or are not evident from the absence of clouds within them or from the masses of clouds in the lower current; it is for this reason that the comparison of motions above, obtained from observations partly simultaneous and partly not, are to a considerable extent independent of each other; yet it will be seen that they in general confirm each other. Thus, the differences of the mean results for the first two comparisons (in Table 97) should give the difference for the third; so in the quadrant S. to W. we have 33°—20° = +13°; and the partly independent comparisons for the cirro-stratous *minus* the scud-current, give +14°; and as the differences of the first and fourth comparisons should give the fifth (in Table 97), we have 36°—20° = +16°; and the partly independent comparisons for the cirrus *minus* scud, give +20°. We obtain similar results in the quadrants E. to S. and W. to N., but the differences of the motions are less marked. This appears to be due chiefly to the greater proportion of negative results in these two quadrants. The means for the *positive* results do not differ greatly in any of the quadrants. In the quadrant N. to E. we find all the three cloud-currents positive of the surface-current, but only to the extent of 2° in the case of the cirro-stratous current; while the cirro-stratous and cirrous currents appear on the whole 1° or 2° negative of the scud-current. These differences appear due to causes belonging chiefly to the sudden appearances of the north-east winds, which are chiefly surface-winds, and are nearly or altogether unconnected with the upper currents.

220. When we combine the results in the four quadrants for each class of comparisons, we have the following means:—

Scud-current *minus* surface-current,	mean of 1434 results,	= +14°·5
Cirro-stratous current *minus* surface-current,	mean of 754 results,	= +22°·8
Cirrous current *minus* surface-current,	mean of 349 results,	= +29°·6
Cirro-stratous current *minus* scud-current,	mean of 683 results,	= + 6°·9
Cirrous current *minus* scud-current,	mean of 339 results,	= +13°·7

It appears, then, that if we take the mean direction of the surface-current as W. 21° S., the directions of the four currents will be nearly as follow :—

Resultant direction of the surface-wind (No. 207),	W. 21° S.
..... scud-current,	W. 7° S.
..... cirro-stratous current,	W. 2° N.
..... cirrous current,	W. 9° N.

The mean resultant direction for the three cloud-currents, giving each an equal value, is W. 1° N. The mean resultant direction of all the currents, giving each an equal value, is W. 4° S.

221. If we neglect the distinctions of the upper currents, and consider merely the differences of all the results for the cloud-currents compared with the surface-wind, we obtain the following numbers :—

Quadrant N. to E.,	499	results, mean upper current *minus* surface-current,	= + 5°·8
..... E. to S.,	179	.....	= + 19°·1
..... S. to W.,	1393	.....	= + 26°·6
..... W. to N.,	466	.....	= + 10°·6

The mean upper current, therefore, is least positive of the surface-current in the quadrant N. to E., and it is most positive in the quadrant S. to W. ; the mean result for each couple of *opposite* quadrants is nearly the same, namely, 15° and 16°.

222. If we compare in a similar manner the mean cirro-stratous and cirrous current with the scud-current in each quadrant, we have,—

Quadrant N. to E.,	157	results, mean cirro-stratous and cirrous current *minus* scud-current,	= − 1°·2
..... E. to S.,	88	.....	= + 15°·9
..... S. to W.,	437	.....	= + 16°·1
..... W. to N.,	340	.....	= + 3°·2

In the quadrant N. to E. the mean of the two upper currents seems to differ nothing from the scud-current, and nearly the same seems to hold for the quadrant W. to N. ; but in the southern quadrants the mean upper current is positive of the scud-current 16°.

223. It appears, then, from the previous numbers, that the mean upper current always proceeds from a point positive of the direction of the *surface*-current, and that the motion of the mean of the higher currents, compared with the motion of the scud-current, obeys the same law in the southern quadrants. These results are in accordance with the conclusions from the causes of the oblique motions of the aërial currents. Currents of air proceeding northwards from more southerly positions retain a portion of the excess of eastward velocity of the places from which they start ; hence the south-easterly winds become more southerly, and the south winds become more south-westerly, as they proceed northwards ; the extent of the change of direction depending on the greater or less rapidity with which they lose their excess of eastward velocity and acquire that of the more northerly latitudes on which they move. This loss of eastward velocity will depend upon the proximity of the aërial stratum to the surface of the earth, and therefore the lower currents of air will lose more of their eastward velocity than the higher currents, and the upper current of southerly winds will become more westerly than the lower currents. If, in considering the currents of air which proceed southwards from more northern latitudes, we remember that the lower currents, from their proximity to the surface of the earth, acquire the greater eastward velocity of the lower latitudes more quickly than the upper currents, it will be evident that the lowest current from the north-west should become less northerly than the upper current, and that the lower current from the north should become less easterly than the upper current. This, it will be observed, agrees with the results previously obtained ; we find, however, in the northern quadrants, that the scud-current differs less from the surface-current than it does in the southern quadrants ; this, it is conceived, is due to the fact that this current is nearer the surface in the northern than in the southern quadrants : it may, however, be due also to the greater proximity of the *origin* of the currents. We find also that the mean upper currents differ little or nothing from the scud-current in the northern quadrants ; it is only necessary to examine the numbers in Table 97 to see that this is not due to the smallness of the differences of motions of these currents, but to the numbers of positive and negative results being more nearly equal. It has been frequently observed that when the lower current of scud is from a north-easterly point the current of cirri is from a north-westerly point : these currents could not have had the same origin, and therefore the explanation of the differences of motions given above cannot apply ; this difference of origin occurs in all the quadrants, and diminishes the apparent effect of the variable velocity of the earth's surface ; it occurs seldomest in the south-west quadrant.

EXTENT OF SKY CLOUDED.

224. *The Mean Extent of Sky Clouded*, from 8 years' observations, = 6·98, totally clouded, being = 10·0.

TABLE 98.—Monthly Means of the Estimated Extent of Clouded Sky, the whole Sky covered being 10, for the Years 1842–50.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
1842					6·32	5·80	7·36	7·15	7·42	5·99	7·46	6·30	
1843	6·40	7·38	6·88	7·77	7·82	7·72	7·87	6·33	5·26	6·20	6·10	6·94	6·89
1844	6·01	6·50	6·30	6·50	6·77	8·12	7·83	7·36	6·95	6·97	8·24	6·96	7·04
1845	7·17	6·69	6·41	6·54	8·34	7·68	8·03	7·97	7·37	7·64	6·56	6·08	7·21
1846	8·06	7·80	7·05	8·27	7·00	5·98	8·71	7·05	7·27	7·21	7·34	5·76	7·29
1847	7·95	5·55	7·45	6·55	7·39	7·03	6·88	7·14	6·04	7·38	6·33	5·96	6·81
1848	6·04	7·67	7·07	7·74	6·45	7·81	7·47	7·03	6·19	6·95	6·76	5·58	6·90
1849	7·17	6·98	7·24	7·77	7·11	5·99	7·23	7·78	6·68	5·98	6·77	5·61	6·86
1850	7·26	6·40	7·01	7·59									
Mean	7·01	6·87	6·93	7·35	7·15	7·02	7·67	7·25	6·65	6·79	6·94	6·15	6·98

225. *Annual Variation of the Extent of Clouded Sky.*—In the mean of 8 years the sky was most clouded in July and least clouded in December; the change from month to month is by no means regular; on the whole, however, the extent of sky clouded is greatest for the 5 months April to August, and it is least in the 4 months September to December. The means for these groups of months are as follow:—

Jan.—Mar. = 6·94. April—August = 7·29. Sept.—Dec. = 6·63.

The means for the meteorological quarters are,—

Winter, Dec.–Feb. = 6·68. Spring, Mar.–May = 7·14. Summer, June–Aug. = 7·31. Autumn, Sept.–Nov. = 6·79

The least extent of sky clouded for any month in the 8 years occurred September 1843 = 5·26.
The greatest extent of sky clouded for any month in the 8 years occurred July 1846 = 8·71.
The mean for the month of December in each year was less than the mean for the year; and the mean for the month of July in each year was greater than the mean for the year.

226. *Variation of the extent of Clouded Sky, with the Moon's Age.*—It is well known that no heat has been detected in the moon-light even with the aid of the largest parabolic reflectors; it was conceived possible, however, that though no thermal indication could be obtained at the surface of the earth, yet there might be some found in the dissipation or formation of clouds in the upper regions of the atmosphere; the observations of the extent of clouded sky for 1843 were accordingly discussed for this purpose in the volume for that year, page 303: the result was very indefinite; it was remarked, however, that as no observations were made in that year between 9^h P.M. and 5^h A.M., the period when the moon's heating effect must be greatest, little else could have been expected. In the volume for 1844, p. 443, the discussion was repeated; from it the extent of clouded sky appeared on the whole greater about full moon than about new moon;—thus, the daily mean for the 15 days about full moon = 7·05, whereas the daily mean for the 15 days about new moon = 7·14; and the daily mean for the 7 days about full moon = 6·94, and about new moon = 7·24. The difference of these numbers is still very small, and it was remarked (1844, p. 443), on account of the irregularities introduced by the sun's cloud-forming power, that it might be desirable to limit the investigation to the hours of the night; this has been done for the years 1844 and 1845 in the present volume, Table XXXIX., page 66, where the extent of clouded sky is given for each day of the moon's age and position in declination in each year, as deduced from the 6-hourly observations between 9^h P.M. and 2^h A.M. It will be seen from No. 229 that the variation of the extent of clouded sky in the mean of the year is small for these hours, which include the epoch

of the minimum in the diurnal variation; they are also the night-hours during which the effect of the full moon must be greatest: upon the whole, this mode of determining the fact, from a short series of observations, seems open to the fewest objections. The following Table contains the means for groups of 3 or 4 days.

TABLE 99.—Variations of the Extent of Clouded Sky for the Six Observation Hours 9^h P.M. to 2^h A.M., with reference to the Moon's Age and Declination for the Years 1844–5.

Moon's Age.	1844.	1845.	Mean.	After Moon farthest North.	1844.	1845.	Mean.
d. d.				d. d.			
14—16	+0·16	+0·55	+0·35	27— 1	+0·63	−0·37	+0·13
17—20	+0·58	+0·59	+0·58	2— 5	+0·21	−0·56	−0·17
21—24	−0·33	−0·51	−0·42	6— 8	−0·03	−0·14	−0·08
25—28	−0·33	−0·51	−0·42	9—12	−0·28	−0·12	−0·20
29— 1	−0·29	−0·39	−0·34	13—15	+0·44	+0·42	+0·43
2— 5	+0·22	−0·62	−0·20	16—19	−0·23	−0·06	−0·15
6— 9	+0·51	+0·02	+0·26	20—22	−0·85	+0·80	−0·02
10—13	−0·52	+0·76	+0·12	23—26	+0·12	+0·01	+0·06

227. The values for each year indicate that the extent of sky clouded was greatest about full moon, and least about new moon; this is shewn with greatest distinctness in the means for 1845. We obtain the same result if we take from Table XXXIX., p. 66, the means for the 15 days with full moon in the middle, and for 15 days with new moon in the middle; these are, for 1844, 6·72 and 6·37; for 1845, 7·10 and 6·23 respectively.

For the years 1844 and 1845, { the mean 15 days about full moon = 6·91
the mean 15 days about new moon = 6·30.

It may be a question still, how far error of estimating the extent of clouded sky in the presence and in the absence of the moon may enter into the production of this result. It is conceived that the effect of error in estimation must be nearly constant: in dark nights the extent of clouded sky was estimated by the space shewing *clear* stars; and it is not improbable that the extent of cloud might be rather over than under estimated during the absence of moon-light; an error which could only have diminished the distinctness of the result obtained. Before we refer the result to the heating effect of the moon, there are other co-ordinate facts to be considered with reference to the motion of the atmosphere. (See No. 200.) We may inquire, however, how far it agrees with the heating effect of the sun, thus;—the extent of clouded sky appears greatest in summer, and least in winter, it appears greatest near noon, and least near midnight; apparently, therefore, the heating effect is to *increase* the amount of cloud, and, *by analogy, we should have the greatest amount of cloud about full moon.**

* Since the previous investigation was performed, I have met with a passage in Sir JOHN HERSCHEL's very excellent "Outlines of Astronomy," page 261, in which he supposes that the lunar heat is extinguished in the upper regions of the atmosphere; and adds, "Some probability is given to this by the *tendency to disappearance of clouds under the full moon*, a meteorological *fact* (for as such we think it fully entitled to rank) for which it is necessary to seek a cause, and for which no other rational explanation seems to offer." He adds as a note to the parenthesis,—"From my own observation, made quite independently of any knowledge of such tendency having been observed by others. Humboldt, however, in his personal narrative, speaks of it as well known to the pilots and seamen of Spanish America (H)."

Sir JOHN's observations were probably purely *qualitative* not quantitative. I have much difficulty in making any objection to the conclusions of so accurate an observer, at the same time if his observations were not of comparative measurement, I must point to the previous conclusions from two years' estimations, and add my own *qualitative* observation for a considerable period, that the clouds are both *formed* and *dissipated* under the influence of full moon, and that they are chiefly cirro-cumuli, or of that kind which I have termed cirro-cumulo-stratus (See No. 217), noticed frequently during the existence of the aurora borealis as the growing and dissipating cloud. Whether the resultant is an excess or defect of cloud during full moon, as compared with other periods, I have no *impression*, and think it extremely difficult to have any. Sir JOHN refers, in an addendum, page xv. of his "Outlines," to what he conceives a fact confirmatory of his conclusion, thus:—"M. ARAGO has shown, from a comparison of rain registered, as having fallen during a long period, that a slight preponderance in respect of quantity falls near new moon over that which falls near the full. This would be a natural and necessary consequence of the preponderance of cloudless sky about the full, and forms, therefore, part and parcel of the same meteorological fact." It will be seen, No. 235, that this result has also been obtained from the Makerstoun Observations, but it may still be a question whether it is confirmatory of Sir JOHN's conclusion. When we compare the annual extent of sky clouded with the annual fall of rain, we do not find any direct connection: I do not know whether the diurnal

228. *Variation of the Extent of Clouded Sky with reference to the Moon's Position in Declination.*—The discussion has been performed for this argument also, and the resulting means are given Table XXXIX., p. 66; and for groups of days, in Table 99. The two years do not agree well. If the cloud depends upon the heating influence of the moon we should expect the greatest value for the most northerly position of the moon; the result, however, would only indicate the excess due to the higher positions of full moon over the lower positions, and as the latter occur in summer, the epoch of maximum cloud, the result becomes complicated with other causes of variation. From the mean of both years the numbers indicate an equal extent of sky clouded for the 14 days about the moon's farthest northerly, and for the 14 days about its farthest southerly positions. When four periods, of seven days each, are considered, the extent of sky clouded is on the whole 0·20 less for the mean of the groups for which the moon is near the equator than for either the northerly or southerly groups.

TABLE 100.—Diurnal Variation of the Estimated Extent of Clouded Sky, for each Astronomical Season and for the Year, deduced from the Observations of the Years 1843–6.

Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. Mean Time.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. m.						h. m.					
12 15	−0·41	−0·43	−0·76	−0·53	−0·52	0 15	+0·59	+0·53	+0·49	+0·57	+0·57
13 15	−0·33	−0·62	−0·63	−0·53	−0·53	1 15	+0·52	+0·60	+0·38	+0·69	+0·55
14 15	−0·46	−0·41	−0·41	−0·53	−0·45	2 15	+0·58	+0·56	+0·20	+0·41	+0·45
15 15	−0·39	−0·30	−0·18	−0·17	−0·27	3 15	+0·64	+0·63	+0·26	+0·28	+0·44
16 15	−0·41	−0·49	−0·21	+0·08	−0·28	4 15	+0·55	+0·31	+0·03	+0·28	+0·30
17 15	−0·14	−0·23	−0·18	+0·28	−0·05	5 15	−0·09	+0·29	−0·06	+0·18	+0·08
18 15	−0·23	+0·02	+0·22	+0·32	+0·09	6 15	−0·38	−0·04	−0·15	+0·01	−0·14
19 15	+0·43	+0·26	+0·41	+0·41	+0·38	7 15	−0·57	−0·33	−0·15	−0·31	−0·34
20 15	+0·54	+0·29	+0·52	+0·35	+0·43	8 15	−0·40	−0·57	−0·34	−0·90	−0·56
21 15	+0·60	+0·52	+0·57	+0·28	+0·50	9 15	−0·43	−0·56	−0·33	−0·78	−0·53
22 15	+0·60	+0·52	+0·53	+0·52	+0·57	10 15	−0·86	−0·75	−0·36	−0·78	−0·69
23 15	+0·65	+0·52	+0·54	+0·60	+0·58	11 15	−0·63	−0·29	−0·48	−0·63	−0·52

229. *Diurnal Variation of the Extent of Clouded Sky.*—The variations in Table 100 have been obtained from the detailed tables for each year in the manner already described for the other meteorological variations. The following are the epochs of the maxima and minima, and mean extent of clouded sky for each quarter and for the year:—

		Maximum.	Mean.	Minimum.	Mean.
Winter,	Nov., Dec., Jan.,	9^h A.M.—3^h P.M.	$6^h\ 35^m$ A.M.	10^h P.M.	$5^h\ 25^m$ P.M.
Spring,	Feb., March, April,	9^h A.M.—3^h P.M.	$6^h\ 10^m$ A.M.	10^h P.M.	$6^h\ 10^m$ P.M.
Summer,	May, June, July,	9^h A.M.	$5^h\ 40^m$ A.M.	12^h P.M.	$4^h\ 35^m$ P.M.
Autumn,	Aug., Sept., Oct.,	1^h P.M.	$3^h\ 55^m$ A.M.	8^h P.M.	$6^h\ 15^m$ P.M.
	Year,	$11^h\ 15^m$ A.M.	$5^h\ 35^m$ A.M.	$10^h\ 15^m$ P.M.	$5^h\ 35^m$ P.M.

law of the amount of rain agrees with that of the extent of clouded sky. There is no doubt, however, that the way in which cloud is generated by the solar heat must be different from that in which it is generated by the lunar heat, the former is due chiefly to heating at the base of the atmosphere, the latter to heating in the upper region; in any case, however, it does not seem evident, from the above considerations, that the lunar heat should generate more cloud than it dissipates.

I may remark, in addition to the above, that the relation of the amount of rain to the amount of cloud must be chiefly a relation to certain kinds of cloud; those formed and dissipated in moonshine are not rain-clouds at all. May it not be for this reason, the conversion of a certain portion of aqueous vapour into clouds which are not rain-clouds that the least rain falls at full moon, while at new moon the same aqueous vapour is probably deposited below as rain-cloud? The cirri, the highest of all clouds, are, I am persuaded, clouds of *crystallization*; are they the least frequent in moonlight? does the moon heat not tend to dissipate them, and to convert them into watery cirro-cumulo-stratus?

I am strongly of opinion that the effect of the lunar influences in the upper regions of our atmosphere is of much greater importance than might seem at all probable: previous investigations have shown that the laws of magnetic disturbance vary more with the positions and age of the moon than with any other argument, and this is especially obvious when we regard the diurnal oscillations. It has also been shewn from the Makerstoun Observations for 8 years, that the frequency of the aurora borealis is greatest near full moon. Scattered throughout the Makerstoun Observations, there will be found frequent reference to remarkable operations occurring in the upper regions of the air near full moon, chiefly among the cirrus, cirro-cumulus, and cirro-cumulo-stratus; this frequency, it is believed, is not wholly due to the better opportunity of observing these processes by moonlight, although that may be partially the case.

I have used throughout the term "extent of clouded sky," because although there is a considerable probability that during a large series of observations the extent of sky clouded will be a measure of the amount of cloud, yet this is not absolutely certain.

The maximum extent of clouded sky occurs earliest in summer, at 9^h A.M., and latest in autumn, about 1^h P.M.; in the other two quarters, however, the value from 9^h A.M. till 3^h P.M. is nearly constant: the minimum occurs earliest in autumn, about 8^h P.M., and latest in summer, near midnight. In the mean for the year the maximum occurs near 11^h A.M. and the minimum near 10^h P.M. The morning mean value occurs earliest in autumn and latest in winter: the afternoon mean value occurs latest in autumn and earliest in summer.

230. *The ranges of the Diurnal Variations of the Extent of Clouded Sky* are as follow:—

Winter = 1·51, Spring = 1·38, Summer = 1·05, Autumn = 1·59. Year = 1·27.

The diurnal range is therefore least in summer and greatest in autumn and winter.

QUANTITY OF RAIN.

TABLE 101.—Quantity of Rain fallen at Makerstoun, according to the Observatory Rain-Gauge, for each Month in the Years 1832–1849.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Sum.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1832	1·58?	1·33	0·73	0·93	2·09	4·70	0·57	3·96	1·27	3·71	3·21	1·89	25·97
1833	0·42	2·03	2·85	1·27	0·87	3·67	1·96	1·39	2·30	2·03	1·30	4·40	24·49
1834	3·37	1·08	0·75	1·38	0·71	1·93	3·80	3·91	3·20	2·21	1·84	1·42	25·60
1835	0·04	2·93	1·29	0·76	1·79	0·51	0·92	2·12	2·96	3·20	3·90	1·50	21·92
1836	1·99	2·61	2·29	1·62	0·49	2·30	4·24	3·08	2·08	3·33	3·25	4·98	32·26
1837	3·03	1·47	1·99	3·18	1·09	2·21	5·67	3·13	2·22	1·35	1·55	2·13	29·02
1838	2·12	1·22	1·90	1·68	1·94	4·39	2·54	2·67	3·13	2·43	2·14	0·71	26·87
1839	1·68	0·98	1·98	0·31	0·43	2·86	2·14	2·13	4·25	3·34	2·82	2·22	25·14
1840	3·05	1·50	0·82	0·09	3·75	3·41	3·10	2·25	3·16	1·97	2·72	0·91	26·73
1841	2·46	1·17	1·39	1·99	1·60	1·87	2·65	4·07	3·68	5·95	2·63	2·14	31·60
1842	1·73	1·35	2·30	0·09	2·27	1·60	1·800	2·201	3·080	1·319	1·846	2·102	21·688
1843	1·978	1·926	0·934	2·231	3·237	1·311	2·676	2·752	1·080	3·645	2·038	0·949	24·757
1844	1·904	2·081	1·632	0·681	0·546	3·083	2·553	1·511	3·104	1·541	2·780	0·363	21·779
1845	1·325	0·712	1·283	1·261	2·217	2·935	1·460	3·158	1·838	4·247	1·699	1·853	23·988
1846	1·901	1·827	2·293	2·272	2·975	2·761	7·124	4·738	4·586	3·506	2·054	1·817	37·854
1847	0·624	0·484	0·330	1·201	4·335	1·970	2·099	1·035	1·375	2·778	1·839	4·006	22·076
1848	1·166	3·780	3·350	1·028	0·350	3·826	1·294	3·223	1·182	4·152	2·252	1·627	27·230
1849	2·775	1·305	0·929	2·480	2·831	2·379	2·383	2·547	1·973	2·417	1·309	2·000	25·328
Monthly Mean.	1·841	1·655	1·613	1·359	1·862	2·651	2·721	2·771	2·582	2·951	2·288	2·056	26·350
Daily Mean.	·0594	·0585	·0520	·0453	0·601	·0884	·0878	·0894	·0861	·0952	·0762	·0663	0·0722

231. The quantities in Table 101, from July 1842 till December 1849, were obtained from the Observatory gauge, which has its funnel-mouth 8 inches above the soil; the quantities from January 1832 till June 1842 are the amounts of rain found in the garden gauge ($6\frac{1}{2}$ feet above the soil), multiplied by factors, constant for each month, which express the ratios of the amounts of rain found in the Observatory gauge to those found in the garden gauge during 6 years; these ratios are as follow:—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1·056	1·030	1·029	1·118	1·071	1·076	1·070	1·053	1·078	1·081	1·061	1·172

The amounts of rain, therefore, in Table 101 were either obtained directly from the Observatory gauge, or they are such as would have been obtained in that gauge.

232. The mean yearly amount of rain at Makerstoun by the Observatory gauge from 18 years' observations = 26·350 inches.

233. The least amount of rain for any of the 18 years was obtained in 1842, when it was 21·688 inches; the amounts for 1835 and 1844 were little more. The greatest amount of rain occurred in 1846, being 37·854 inches. The least monthly fall of rain occurred January 1835, being only 0·04 inch. The greatest monthly fall of rain occurred July 1846, being = 7·124 inches.

234. *Annual Variation of the Fall of Rain.*—From the means for 18 years at the foot of Table 101, the greatest amount of rain fell in October, and the least fell in April, the daily average for the latter month being rather less than half that for the former. The amounts of rain for the months of June, July, August, September, and October, differ little, the average daily fall for these 5 months being 0·0894 inch. The daily means for the quarterly groups with the greatest range of values are as follow :—

		in.			in.
Winter,	Nov., Dec., Jan.,	= 0·0673	Summer,	June, July, Aug.,	= 0·0788
Spring,	March, April, May,	= 0·0519	Autumn,	Sept., Oct., Nov.,	= 0·0902

Year, in. = 0·0722

235. *Amount of Rain with reference to the Moon's Age.*—This discussion was given in the volume for 1844, p. 447. The result, as obtained from 6 years' observations of the Observatory gauge, may be stated shortly thus :—

The average daily fall of rain during the second and third quarters = 0·0654 inch.
..... fourth and first ..... = 0·0750 inch.

So that a greater amount of rain fell about new than about full moon. (See Foot-note to No. 227.)

TABLES OF RESULTS

FROM THE

MAGNETICAL OBSERVATIONS

MADE AT THE OBSERVATORY OF

GENERAL SIR T. M. BRISBANE, BART.,

MAKERSTOUN.

1845 AND 1846.

TABLE I.—Mean Westerly Declination for each Civil Week-Day and Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′
1	12·78	15·12	13·48	11·48	11·19	[11·52]	10·70	11·16	09·81	11·53	08·93	08·21
2	13·78	[14·88]	[13·39]	12·16	10·65	11·32	10·55	11·51	11·63	11·41	[10·16]	09·10
3	14·20	14·55	13·34	11·77	10·17	11·26	11·76	[11·21]	10·25	11·43	11·10	10·29
4	13·47	14·38	13·52	12·17	[10·88]	12·46	11·34	12·33	10·85	11·31	09·77	06·86
5	[14·07]	16·13	13·28	11·52	10·90	11·43	10·99	10·44	09·89	[11·01]	11·64	10·21
6	14·27	14·73	13·52	[11·79]	10·81	10·86	[11·33]	11·36	10·41	11·41	10·77	08·51
7	14·00	14·17	13·83	12·17	11·57	11·31	10·81	10·88	[10·22]	10·44	12·06	[09·42]
8	14·73	13·77	14·10	11·76	11·59	[11·36]	11·96	12·57	11·25	10·07	11·00	08·75
9	11·87	[13·98]	[13·61]	11·38	11·43	11·01	11·10	11·82	09·26	08·40	[10·64]	08·22
10	11·04	13·35	13·41	11·84	11·04	11·01	10·85	[10·83]	10·04	10·79	10·08	08·99
11	14·60	13·79	13·12	11·46	[11·53]	12·56	11·04	09·99	09·89	11·04	09·63	08·16
12	[13·61]	14·05	13·66	11·53	11·31	11·39	12·02	09·54	10·87	[10·27]	10·28	08·90
13	15·53	13·39	14·84	[10·68]	11·71	10·40	[11·17]	10·19	09·79	10·50	09·91	07·57
14	14·77	14·04	13·18	06·59	12·09	10·76	10·97	09·21	[10·00]	10·22	10·19	[08·02]
15	13·84	13·57	13·83	11·38	11·48	[10·83]	11·16	11·43	09·70	10·70	10·07	06·96
16	14·88	[13·62]	[13·61]	11·30	12·19	11·23	11·00	10·51	10·17	10·88	[09·83]	08·01
17	14·65	13·52	13·48	11·00	11·45	11·03	11·07	[10·72]	09·59	11·89	11·53	08·55
18	15·26	13·59	13·18	11·05	[11·81]	10·19	11·13	11·39	10·15	10·29	08·31	08·43
19	[14·58]	13·59	13·13	09·66	12·78	11·21	11·28	11·13	10·77	[10·95]	08·99	08·32
20	13·31	13·86	13·02	[11·02]	12·22	10·93	[11·13]	10·63	09·89	11·37	09·09	07·53
21	14·58	13·55	13·25	11·20	10·72	11·64	11·45	10·16	[10·55]	10·73	08·10	[08·25]
22	14·82	14·42	13·23	11·39	10·68	[11·20]	11·32	10·67	10·75	10·56	08·62	08·18
23	14·38	[13·42]	[12·67]	11·84	11·55	11·42	10·55	10·66	10·81	11·08	[08·44]	08·37
24	14·21	11·37	13·53	13·00	11·97	10·71	10·33	[10·38]	10·94	11·73	08·53	08·68
25	14·38	13·33	11·04	12·44	[11·20]	11·28	12·47	10·39	10·66	11·39	08·30	08·05
26	[14·14]	13·98	11·96	12·51	11·01	10·97	10·93	10·03	11·82	[10·98]	07·98	07·97
27	13·21	12·61	12·33	[11·69]	11·27	11·11	[11·03]	10·39	09·71	11·13	08·03	08·47
28	13·52	14·12	11·69	09·57	10·71	11·42	11·01	09·73	[10·74]	10·47	09·07	[08·08]
29	15·16		12·33	11·28	11·08	[11·04]	10·97	09·07	10·45	10·08	07·20	06·60
30	14·30		[12·07]	11·34	09·85	11·49	10·45	09·68	10·25	10·36	[08·65]	07·79
31	14·83		12·46		13·14		10·44	[10·09]		09·18		09·62

TABLE II.—Mean Variations of Westerly Declination, after Eliminating the Secular Change, with reference to the Moon's Age, Declination, and Distance from the Earth, for 1845.

Moon's Age.	Variations of West Declination.	Moon's Age.	Variations of West Declination.	After Moon farthest North.	Variations of West Declination.	After Moon farthest North.	Variations of West Declination.	Before and after Perigee.	Variations of West Declination.	Before and after Apogee.	Variations of West Declination.
Day.	′	Day.	′	Day.	′	Day.	′	Day.	′	Day.	′
15	0·34	0	0·41	0	0·45	14	0·56	7	0·17	7	0·01
16	0·47	1	0·27	1	0·57	15	0·45	6	0·43	6	0·59
17	0·28	2	0·00	2	0·31	16	0·48	5	0·09	5	0·45
18	0·55	3	0·61	3	0·08	17	0·33	4	0·33	4	0·25
19	0·10	4	0·59	4	0·63	18	0·33	3	0·09	3	0·25
20	0·22	5	0·65	5	0·43	19	0·86	2	0·03	2	0·72
21	0·21	6	0·83	6	0·60	20	0·57	1	0·10	1	0·14
22	0·15	7	0·43	7	0·42	21	0·49	P	0·36	A	0·22
23	0·35	8	0·10	8	0·00	22	0·42	1	0·40	1	0·16
24	0·25	9	0·43	9	0·51	23	0·56	2	0·50	2	0·00
25	0·61	10	0·43	10	0·58	24	0·71	3	0·10	3	0·21
26	0·02	11	0·43	11	0·48	25	0·58	4	0·37	4	0·41
27	0·07	12	0·30	12	0·38	26	0·81	5	0·26	5	0·25
28	0·12	13	0·36	13	0·26	27	0·64	6	0·25	6	0·43
29	0·55	14	0·47					7	0·10	7	0·23

TABLE III.—Diurnal Range of Magnetic Declination for each Civil Day, as deduced from the Hourly Observations, with the Mean for each Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	′	′	′	′	′	′	′	′	′	′	′	′
1	9·71	6·68	14·08	10·34	21·21	[15·50]	14·43	29·87	15·44	13·52	18·17	5·18
2	10·65	[10·37]	[14·69]	12·99	9·53	10·76	8·70	19·87	20·00	8·50	[14·92]	12·13
3	3·81	7·73	9·53	16·86	12·17	10·76	10·87	[17·36]	19·74	15·78	12·56	31·83
4	3·74	11·70	7·24	14·23	[13·36]	17·54	14·59	16·88	15·20	8·39	12·91	20·17
5	[5·57]	15·54	6·58	13·94	9·93	13·22	9·87	10·97	16·34	[10·73]	23·98	10·51
6	2·62	14·84	7·40	[14·34]	13·19	13·39	[12·59]	13·03	13·65	11·62	4·87	8·80
7	7·73	13·11	11·36	13·89	14·14	16·46	15·06	11·42	[14·50]	10·59	16·27	[9·51]
8	4·89	5·69	9·06	13·18	12·36	[14·88]	14·76	21·60	20·69	9·49	7·18	6·86
9	37·83	[9·96]	[9·84]	13·97	14·56	19·31	10·39	18·79	11·06	30·88	[9·76]	3·79
10	31·14	13·33	10·38	12·34	11·17	15·76	14·69	[14·65]	10·05	26·76	13·95	6·95
11	9·86	6·76	13·34	14·95	[13·22]	11·16	13·86	11·63	16·42	9·21	9·18	5·28
12	[18·78]	6·05	7·48	15·35	14·41	14·03	9·38	11·44	13·36	[14·94]	7·11	6·67
13	9·38	8·07	12·24	[22·48]	12·71	12·28	[12·70]	13·03	14·90	6·31	4·15	32·87
14	9·82	5·00	19·71	67·37	14·14	15·86	12·52	9·37	[16·02]	6·58	5·06	[15·63]
15	14·65	3·26	15·38	15·11	17·26	[12·56]	13·60	19·75	7·58	9·89	4·63	27·56
16	5·80	[5·90]	[16·20]	9·77	18·44	12·83	12·15	15·49	13·89	9·22	[11·48]	12·79
17	6·76	7·86	15·59	10·10	11·20	9·24	15·14	[14·86]	30·00	20·70	25·30	8·61
18	6·92	5·54	16·25	18·30	[15·81]	11·14	13·99	18·52	27·22	13·16	21·02	15·49
19	[13·70]	5·67	18·05	17·56	19·31	14·16	16·15	13·36	18·84	[19·52]	8·70	3·50
20	40·16	15·26	19·12	[14·58]	15·76	15·21	[14·14]	12·65	13·29	22·61	6·82	8·21
21	16·35	22·74	11·32	13·44	12·91	18·42	11·03	14·78	[15·47]	36·57	6·33	[7·60]
22	6·20	14·81	14·49	12·63	18·07	[14·20]	13·05	15·71	10·71	14·85	9·74	5·49
23	19·98	[20·66]	[18·64]	15·47	12·44	13·39	15·48	18·49	9·08	5·52	[8·13]	6·73
24	17·56	33·12	20·68	15·11	14·38	13·88	12·02	[15·63]	13·71	11·69	10·47	6·20
25	17·84	17·84	26·63	18·34	[11·91]	10·17	26·07	16·15	29·96	13·26	8·44	4·22
26	[19·81]	20·20	19·59	14·90	8·19	11·92	11·00	16·77	11·74	[9·69]	6·98	5·01
27	18·34	29·63	13·88	[16·51]	9·01	13·86	[13·38]	11·91	34·57	8·20	9·91	6·39
28	19·68	21·06	22·25	22·18	9·38	18·28	9·06	12·41	[19·25]	11·27	10·19	[8·17]
29	25·48		17·51	14·39	10·87	[13·08]	10·90	37·11	11·12	8·23	10·56	4·07
30	15·00		[14·50]	14·16	14·40	11·29	11·23	22·00	14·60	7·70	[13·30]	16·99
31	5·58		10·02		28·70		13·55	[21·12]		14·19		12·36

TABLE IV.—Means of the Diurnal Ranges of Magnetic Declination, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	′	Day.	′	Day.	′	Day.	′
15	14·33	0	12·07	0	13·97	14	12·33
16	16·75	1	14·54	1	15·57	15	11·07
17	15·51	2	14·51	2	17·90	16	12·10
18	17·29	3	12·90	3	18·86	17	18·82
19	16·24	4	14·54	4	13·88	18	15·09
20	15·74	5	12·78	5	16·68	19	12·79
21	17·28	6	13·65	6	13·14	20	11·32
22	12·93	7	12·94	7	15·62	21	11·03
23	11·82	8	16·92	8	15·30	22	13·95
24	12·54	9	12·05	9	14·54	23	14·15
25	12·25	10	11·30	10	14·52	24	10·41
26	13·75	11	12·11	11	13·56	25	11·50
27	11·37	12	13·98	12	11·25	26	11·94
28	12·39	13	11·85	13	13·08	27	12·43
29	12·83	14	13·31				

TABLE V.—Hourly Means of Westerly Declination for each Month in 1845.

Mean Time. Gött.	Mean Time. Mak.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	h.	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′
13	12	12·11	11·33	11·24	09·86	09·62	10·13	09·54	08·48	08·78	07·74	08·44	06·64	09·49
14	13	12·17	12·50	11·20	09·29	09·21	09·96	08·69	07·89	07·81	08·59	08·73	06·80	09·40
15	14	11·97	12·84	12·19	07·31	09·68	09·53	08·31	09·57	08·24	08·39	09·48	07·73	09·60
16	15	11·71	13·31	11·15	08·63	09·48	08·82	09·55	08·98	07·18	09·53	09·11	07·89	09·61
17	16	12·93	12·99	10·29	10·31	08·49	07·23	08·48	07·28	08·10	09·59	08·69	08·64	09·42
18	17	13·47	12·53	11·41	08·83	07·33	05·96	07·37	06·57	07·83	10·02	08·57	07·79	08·97
19	18	14·47	13·17	11·27	08·10	06·25	05·38	06·90	06·22	08·91	10·17	09·14	08·21	09·01
20	19	14·84	13·23	11·26	06·90	05·97	05·83	06·57	07·05	08·73	09·57	09·02	08·22	08·93
21	20	15·17	13·75	11·50	06·61	07·87	06·84	07·76	08·32	10·40	09·05	09·33	08·45	09·59
22	21	15·76	14·59	12·36	08·29	09·86	09·16	09·52	10·08	11·38	09·91	10·37	08·30	10·80
23	22	16·57	15·56	13·76	11·46	13·11	12·37	11·66	12·46	13·44	12·43	11·77	09·42	12·83
0	23	17·03	17·58	16·41	14·99	16·09	16·08	14·25	15·73	15·98	14·93	12·71	10·91	15·22
1	0	17·37	18·48	19·08	18·21	17·81	17·74	16·57	18·04	17·71	16·30	13·39	12·06	16·90
2	1	17·63	18·64	19·96	19·69	18·39	17·90	17·43	18·89	17·20	16·51	13·38	12·36	17·33
3	2	16·57	17·54	19·18	18·66	17·60	17·53	16·88	17·77	15·60	15·42	12·68	11·23	16·38
4	3	16·02	15·53	17·51	16·56	15·62	15·86	15·85	15·40	13·12	13·63	11·36	10·55	14·75
5	4	15·53	15·09	15·14	14·97	13·94	14·24	14·44	13·24	10·92	11·70	10·25	09·03	13·21
6	5	13·97	13·74	12·69	12·82	12·00	12·49	13·06	11·06	09·97	10·79	09·22	07·78	11·63
7	6	13·96	12·01	11·67	11·11	11·11	11·55	11·69	08·59	08·49	10·84	09·23	07·09	10·61
8	7	12·53	11·99	11·71	10·05	10·83	11·36	11·33	09·28	08·47	10·44	07·49	07·13	10·22
9	8	12·39	11·56	11·59	09·10	10·75	11·24	10·62	09·68	07·64	09·87	07·34	06·04	09·82
10	9	11·57	11·73	10·04	09·69	10·30	10·91	10·16	08·56	07·38	08·18	06·85	05·94	09·28
11	10	11·68	11·36	11·11	10·22	10·78	10·76	10·15	07·97	08·08	07·44	05·89	06·13	09·30
12	11	10·68	12·00	11·70	10·48	10·38	10·31	09·60	08·46	07·50	07·09	07·19	05·93	09·28

TABLE VI.—Diurnal Variations of Westerly Declination for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
12	1·43	0·00	1·20	3·25	3·65	4·75	2·97	2·26	1·60	0·65	2·55	0·71	0·56
13	1·49	1·17	1·16	2·68	3·24	4·58	2·12	1·67	0·63	1·50	2·84	0·87	0·47
14	1·29	1·51	2·15	0·70	3·71	4·15	1·74	3·35	1·06	1·30	3·59	1·80	0·67
15	1·03	1·98	1·11	2·02	3·51	3·44	2·98	2·76	0·00	2·44	3·22	1·96	0·68
16	2·25	1·66	0·25	3·70	2·52	1·85	1·91	1·06	0·92	2·50	2·80	2·71	0·49
17	2·79	1·20	1·37	2·22	1·36	0·58	0·80	0·35	0·65	2·93	2·68	1·86	0·04
18	3·79	1·84	1·23	1·49	0·28	0·00	0·33	0·00	1·73	3·08	3·25	2·28	0·08
19	4·16	1·90	1·22	0·29	0·00	0·45	0·00	0·83	1·55	2·48	3·13	2·29	0·00
20	4·49	2·42	1·46	0·00	1·90	1·46	1·19	2·10	3·22	1·96	3·44	2·52	0·66
21	5·08	3·26	2·32	1·68	3·89	3·78	2·95	3·86	4·20	2·82	4·48	2·37	1·87
22	5·89	4·23	3·72	4·85	7·14	6·99	5·09	6·24	6·26	5·34	5·88	3·49	3·90
23	6·35	6·25	6·37	8·38	10·12	10·70	7·68	9·51	8·80	7·84	6·82	4·98	6·29
0	6·69	7·15	9·04	11·60	11·87	12·36	10·00	11·82	10·53	9·21	7·50	6·13	7·97
1	6·95	7·31	9·92	13·08	12·42	12·52	10·86	12·67	10·02	9·42	7·49	6·43	8·40
2	5·89	6·21	9·14	12·05	11·63	12·15	10·31	11·55	8·42	8·33	6·79	5·30	7·45
3	5·34	4·20	7·47	9·95	9·65	10·48	9·28	9·18	5·94	6·54	5·47	4·62	5·82
4	4·85	3·76	5·10	8·36	7·97	8·88	7·87	7·02	3·74	4·61	4·36	3·10	4·28
5	3·29	2·41	2·65	6·21	6·03	7·11	6·49	4·84	2·79	3·70	3·33	1·85	2·70
6	3·28	0·68	1·63	4·50	5·14	6·17	5·12	2·37	1·31	3·75	3·34	1·16	1·68
7	1·85	0·66	1·67	3·44	4·86	5·98	4·76	3·06	1·29	3·35	1·60	1·20	1·29
8	1·71	0·23	1·55	2·49	4·78	5·86	4·05	3·46	0·46	2·78	1·45	0·11	0·89
9	0·89	0·40	0·00	3·08	4·33	5·53	3·59	2·34	0·20	1·09	0·96	0·01	0·35
10	1·00	0·03	1·07	3·61	4·81	5·38	3·58	1·75	0·90	0·35	0·00	0·20	0·37
11	0·00	0·67	1·64	3·87	4·41	4·93	3·03	2·24	0·32	0·00	1·30	0·00	0·35

TABLE VII.—List of Seven Days in each Month of 1845 upon which the Magnetic Declination was least irregular.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
3	8	4	5	2	3	5	11	6	6	6	1
4	11	5	10	3	6	14	12	10	13	8	9
6	12	6	12	7	12	15	13	15	14	12	11
8	14	8	17	9	13	16	16	16	16	13	19
16	15	12	23	26	18	23	19	22	23	14	24
18	18	13	24	27	19	26	20	23	24	15	25
31	19	31	26	28	27	30	21	24	30	20	27

TABLE VIII.—Hourly Means of Magnetic Declination for the Seven Days least disturbed in each Month of 1845, corrected so that the Mean of each Seven Days equals the Monthly Mean.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′
12	13·71	12·63	12·41	09·85	11·15	10·61	10·04	09·80	09·94	09·71	09·08	07·62	10·55
13	13·36	13·79	12·05	10·21	10·93	10·89	09·62	09·13	09·43	09·48	09·02	07·91	10·48
14	13·69	13·72	11·65	10·08	10·70	10·14	09·05	09·52	08·83	09·74	09·05	08·15	10·36
15	13·38	13·26	11·28	09·42	10·28	08·96	08·76	08·98	07·80	10·05	09·30	08·22	09·97
16	13·51	12·79	11·33	08·99	09·50	07·59	07·81	08·33	08·07	09·67	09·12	07·94	09·55
17	13·38	12·76	11·31	07·96	08·05	06·26	06·22	06·73	07·41	09·51	09·06	08·07	08·89
18	13·22	12·80	11·24	07·66	06·91	05·50	05·89	05·83	06·93	09·47	08·77	07·74	08·50
19	13·25	12·94	11·26	06·26	06·13	05·39	06·14	05·60	07·08	08·91	08·46	07·58	08·25
20	13·68	13·19	11·14	06·26	07·24	06·05	07·30	05·73	07·80	08·64	08·46	07·63	08·59
21	14·36	13·77	11·67	07·51	09·27	08·11	09·15	08·33	09·44	09·32	09·09	07·32	09·78
22	15·32	14·83	12·85	10·67	12·23	11·54	11·50	12·09	12·01	12·19	10·87	08·36	12·04
23	16·42	16·20	15·34	14·53	15·11	15·37	14·50	15·15	15·19	14·36	12·35	09·92	14·54
0	15·88	16·95	17·90	18·02	16·46	17·50	16·84	17·46	16·94	15·74	12·44	11·05	16·10
1	16·13	17·00	18·32	19·62	16·87	17·70	17·65	18·23	16·71	15·75	12·28	11·19	16·45
2	15·11	16·21	17·81	18·25	15·71	17·37	16·37	17·22	14·54	14·07	11·20	10·59	15·37
3	14·98	14·98	16·18	16·52	14·39	16·26	15·22	14·74	12·42	12·60	10·26	09·43	14·00
4	14·46	14·13	14·05	14·89	12·84	14·26	14·15	12·23	10·98	10·80	09·97	08·33	12·59
5	14·05	13·83	13·05	13·16	11·63	12·21	13·51	10·28	10·23	10·70	09·48	08·24	11·70
6	13·78	13·43	13·26	11·69	10·99	11·56	12·37	09·52	09·76	10·06	09·31	08·28	11·17
7	13·73	13·31	12·77	10·90	10·94	11·55	11·75	09·95	09·75	09·57	08·76	08·05	10·92
8	13·46	12·93	12·39	09·74	11·28	11·26	11·51	10·31	09·97	09·70	08·56	07·43	10·71
9	13·05	12·77	11·76	09·93	11·39	11·22	10·92	10·41	09·00	09·55	07·94	06·81	10·40
10	13·22	12·20	12·33	10·14	11·25	11·25	10·26	10·29	09·49	09·28	08·42	07·06	10·43
11	13·05	12·78	12·14	09·96	11·20	10·67	09·94	09·66	09·18	09·44	08·42	07·25	10·31

TABLE IX.—Variations of Magnetic Declination with reference to the Moon's Hour-Angle for each Lunation, for the Six Summer and Seven Winter Lunations, and for the whole Thirteen Lunations of 1845.

Moon's Hour-Angle.	Lunations.															
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	Summer.	Winter.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
0	0·94	0·17	1·04	0·68	0·92	2·50	1·45	1·51	1·08	2·03	0·72	1·18	0·96	0·81	0·55	0·34
1	0·95	0·01	1·40	1·54	0·43	2·27	0·86	1·58	0·91	2·60	0·75	0·58	0·54	0·71	0·52	0·28
2	1·46	0·68	0·69	3·04	0·54	1·99	0·57	1·75	1·21	2·05	1·02	1·93	1·23	0·97	0·84	0·57
3	0·00	0·48	1·37	2·83	0·23	1·61	0·24	1·35	1·16	0·79	0·89	1·02	0·80	0·69	0·31	0·15
4	0·60	1·20	0·00	3·07	0·47	1·80	0·72	1·36	1·45	1·07	0·94	0·88	1·00	0·93	0·36	0·29
5	0·96	1·46	1·42	2·84	0·85	1·73	0·45	0·87	1·76	1·66	1·24	0·97	0·75	0·87	0·75	0·47
6	0·64	0·89	0·71	2·79	1·04	1·89	0·89	0·26	1·80	2·02	0·94	0·61	0·25	0·90	0·41	0·30
7	1·53	0·77	0·86	2·20	0·35	1·36	1·03	0·65	1·25	2·32	1·13	0·93	1·25	0·59	0·80	0·37
8	1·66	1·29	1·67	2·04	0·00	0·97	0·75	0·87	0·78	2·20	0·88	0·89	0·94	0·35	0·90	0·32
9	1·46	1·03	1·50	0·00	0·01	0·89	1·24	0·50	0·66	1·03	1·07	0·68	0·74	0·00	0·62	0·00
10	0·81	1·33	2·06	1·08	0·26	0·53	1·42	0·47	1·31	1·03	0·99	0·96	1·21	0·29	0·74	0·20
11	1·29	1·14	2·15	1·93	0·97	0·24	0·85	1·73	1·17	1·60	1·23	1·02	1·23	0·60	0·92	0·44
12	0·93	1·25	0·37	1·86	1·38	0·00	0·91	0·00	0·00	2·61	1·08	0·98	1·52	0·14	0·79	0·16
13	1·81	0·71	2·31	1·77	1·35	0·52	1·12	0·22	0·91	2·28	0·76	0·76	1·00	0·43	0·92	0·36
14	1·29	0·13	1·79	1·83	1·62	0·54	1·20	0·84	1·06	1·61	1·02	0·61	0·87	0·63	0·59	0·28
15	1·12	1·46	1·38	2·04	0·96	0·37	0·18	1·19	0·52	1·70	1·16	1·61	1·10	0·33	0·90	0·31
16	1·16	1·34	0·84	1·36	1·41	0·56	0·26	0·23	0·94	1·45	1·13	1·48	0·67	0·24	0·70	0·16
17	1·83	0·00	0·57	1·16	0·71	0·83	0·19	0·57	1·15	1·62	0·41	1·21	0·68	0·22	0·45	0·01
18	1·70	0·30	0·56	2·17	0·76	0·60	0·55	0·55	1·38	1·05	1·01	1·30	0·00	0·45	0·39	0·09
19	2·20	0·44	1·03	2·87	1·14	0·30	0·00	0·25	1·10	0·00	0·51	0·00	0·96	0·39	0·28	0·00
20	2·04	0·17	1·13	2·53	0·70	0·41	0·19	0·43	0·94	1·30	0·23	1·58	0·05	0·32	0·47	0·07
21	1·27	0·25	1·14	2·66	0·97	0·58	0·62	0·05	1·29	0·77	0·73	1·20	0·66	0·48	0·40	0·11
22	0·04	1·90	0·33	2·45	1·09	1·37	0·85	0·63	1·77	0·37	0·00	0·31	0·25	0·81	0·00	0·04
23	1·23	0·21	1·94	1·78	0·93	1·96	1·74	1·37	1·13	1·83	0·37	1·19	0·62	0·93	0·60	0·42
24	1·12	0·20	0·10	2·15	1·36	2·18	1·47	1·74	1·76	2·22	0·06	1·42	0·55	1·23	0·35	0·43

TABLE X.—Differences of the Hourly Means of Westerly Declination, as deduced from the whole Series, and the Seven-Day Series selected in each Month; or Table V. *minus* Table VIII.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
12	−1·60	−1·30	−1·17	+0·01	−1·53	−0·48	−0·50	−1·32	−1·16	−1·97	−0·64	−0·98	−1·06
13	−1·19	−1·29	−0·85	−0·92	−1·72	−0·93	−0·93	−1·24	−1·62	−0·89	−0·29	−1·11	−1·08
14	−1·72	−0·88	+0·54	−2·77	−1·02	−0·61	−0·74	+0·05	−0·59	−1·35	+0·43	−0·42	−0·76
15	−1·67	+0·05	−0·13	−0·79	−0·80	−0·14	+0·79	0·00	−0·62	−0·52	−0·19	−0·33	−0·36
16	−0·58	+0·20	−1·04	+1·32	−1·01	−0·36	+0·67	−1·05	+0·03	−0·08	−0·43	+0·70	−0·13
17	+0·09	−0·23	+0·10	+0·87	−0·72	−0·30	+1·15	−0·16	+0·42	+0·51	−0·49	−0·28	+0·08
18	+1·25	+0·37	+0·03	+0·44	−0·66	−0·12	+1·01	+0·39	+1·98	+0·70	+0·37	+0·47	+0·51
19	+1·59	+0·29	0·00	+0·64	−0·16	+0·44	+0·43	+1·45	+1·65	+0·66	+0·56	+0·64	+0·68
20	+1·49	+0·56	+0·36	+0·35	+0·63	+0·79	+0·46	+2·59	+2·60	+0·41	+0·87	+0·82	+1·00
21	+1·40	+0·82	+0·69	+0·78	+0·59	+1·05	+0·37	+1·75	+1·94	+0·59	+1·28	+0·98	+1·02
22	+1·25	+0·73	+0·91	+0·79	+0·88	+0·83	+0·16	+0·37	+1·43	+0·24	+0·90	+1·06	+0·79
23	+0·61	+1·38	+1·07	+0·46	+0·98	+0·71	−0·25	+0·58	+0·79	+0·57	+0·36	+0·99	+0·68
0	+1·49	+1·53	+1·18	+0·19	+1·38	+0·24	−0·27	+0·58	+0·77	+0·56	+0·95	+1·01	+0·80
1	+1·50	+1·64	+1·64	+0·07	+1·52	+0·20	−0·22	+0·66	+0·49	+0·76	+1·10	+1·17	+0·88
2	+1·46	+1·33	+1·37	+0·41	+1·89	+0·16	+0·51	+0·55	+1·06	+1·35	+1·48	+0·64	+1·01
3	+1·04	+0·55	+1·33	+0·04	+1·23	−0·40	+0·63	+0·66	+0·72	+1·03	+1·10	+1·12	+0·75
4	+1·07	+0·96	+1·09	+0·08	+1·10	−0·02	+0·29	+1·01	−0·06	+0·90	+0·28	+0·70	+0·62
5	−0·08	−0·09	−0·36	−0·34	+0·37	+0·28	−0·45	+0·78	−0·26	+0·09	−0·26	−0·46	−0·07
6	+0·18	−1·42	−1·59	−0·58	+0·12	−0·01	−0·68	−0·93	−1·27	+0·78	−0·08	−1·19	−0·56
7	−1·20	−1·32	−1·06	−0·85	−0·11	−0·19	−0·42	−0·67	−1·28	+0·87	−1·27	−0·92	−0·70
8	−1·07	−1·37	−0·80	−0·64	−0·53	−0·02	−0·89	−0·63	−2·33	+0·17	−1·22	−1·39	−0·89
9	−1·48	−1·04	−1·72	−0·24	−1·09	−0·31	−0·76	−1·85	−1·62	−1·37	−1·09	−0·87	−1·12
10	−1·54	−0·84	−1·22	+0·08	−0·47	−0·49	−0·11	−2·32	−1·41	−1·84	−2·53	−0·93	−1·13
11	−2·37	−0·78	−0·44	+0·52	−0·82	−0·36	−0·34	−1·20	−1·68	−2·35	−1·23	−1·32	−1·03

TABLE XI.—Mean Difference of a Single Observation of the Magnetic Declination, from the Monthly Mean at the corresponding Hour, for each Civil Day and Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	′	′	′	′	′	′	′	′	′	′	′	′
1	1·57	1·64	1·32	1·13	3·00	[1·94]	1·45	3·23	1·94	1·33	2·51	1·07
2	1·91	[1·55]	[1·75]	1·10	1·35	1·22	1·64	2·53	3·21	0·92	[2·07]	1·51
3	1·35	1·13	1·27	1·49	1·66	1·11	1·14	[2·06]	2·71	1·64	2·01	5·05
4	1·53	1·20	1·47	1·30	[1·63]	2·14	1·42	2·53	1·88	1·12	1·45	3·10
5	[1·63]	2·39	1·30	0·91	1·32	0·93	0·73	1·95	1·55	[1·22]	3·40	2·16
6	1·74	1·81	1·54	[1·24]	1·45	0·73	[1·38]	1·12	1·33	1·55	1·31	1·00
7	1·48	1·20	1·32	1·40	1·01	1·42	1·53	1·40	[1·92]	0·98	3·04	[1·52]
8	1·79	0·94	1·24	1·35	0·72	[1·30]	1·71	2·64	2·93	1·09	1·69	0·89
9	4·04	[1·13]	[1·29]	0·99	0·72	2·03	1·73	2·01	1·73	3·01	[1·65]	1·21
10	3·82	1·36	1·08	0·90	0·84	1·05	1·59	[1·75]	2·10	3·02	1·23	0·77
11	1·70	0·95	1·07	1·11	[1·00]	1·62	1·29	1·15	1·22	1·46	1·52	0·80
12	[2·28]	0·53	1·52	0·83	1·10	0·77	1·10	1·84	1·21	[1·97]	1·10	1·12
13	1·70	1·28	1·78	[1·98]	1·11	1·38	[1·20]	1·46	1·39	1·42	0·98	3·77
14	1·21	1·16	2·71	6·47	1·49	1·35	1·21	1·66	[1·37]	1·47	1·03	[1·91]
15	1·23	1·24	1·54	1·62	1·90	[1·09]	1·25	1·83	1·56	1·45	1·02	2·60
16	1·38	[1·22]	[1·90]	0·93	1·64	0·64	0·78	1·35	0·70	0·93	[1·67]	1·56
17	1·01	1·63	2·01	1·14	1·34	1·19	1·26	[1·50]	2·12	2·36	2·96	1·62
18	1·44	0·95	1·35	1·81	[1·60]	1·24	1·00	2·42	2·70	1·28	2·13	1·68
19	[2·00]	1·05	1·99	2·07	2·53	0·49	1·49	0·85	1·74	[2·25]	1·88	0·95
20	5·05	1·78	2·62	[1·50]	1·21	1·00	[1·11]	0·87	1·66	2·34	1·24	1·22
21	1·80	3·50	1·32	1·72	1·01	1·88	0·96	1·27	[1·89]	4·80	1·74	[1·18]
22	1·35	2·01	1·17	1·22	1·70	[1·05]	0·53	1·23	1·39	1·81	1·12	1·04
23	1·68	[2·99]	[2·38]	1·04	0·92	0·78	1·40	1·70	1·92	1·30	[1·47]	1·24
24	2·07	5·15	3·72	2·10	1·14	1·12	2·15	[1·35]	1·91	1·39	1·28	0·98
25	2·39	2·92	2·56	2·07	[1·17]	1·03	5·58	1·34	5·47	1·80	1·79	0·93
26	[2·40]	2·58	2·90	1·29	1·16	0·64	0·99	1·68	2·13	[1·29]	1·64	0·97
27	2·34	2·74	2·00	[1·97]	0·97	0·58	[1·97]	0·90	3·68	0·94	1·59	0·71
28	1·81	2·43	2·07	3·56	1·11	1·64	1·15	1·24	[2·67]	1·29	1·47	[1·45]
29	4·14		1·89	1·08	0·85	[1·32]	1·02	4·43	1·79	1·01	2·57	1·89
30	1·77		[1·55]	1·73	2·16	2·00	0·93	3·78	1·62	1·03	[2·21]	2·17
31	1·18		1·11		4·16		1·00	[2·88]		2·05		2·05

TABLE XII.—Mean Difference of a Single Observation of the Magnetic Declination from the Monthly Mean at the corresponding Hour, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Difference.	Moon's Age.	Mean Difference.	After Moon farthest North.	Mean Difference.	After Moon farthest North.	Mean Difference.
Day.	′	Day.	′	Day.	′	Day.	′
15	1·57	0	1·57	0	1·38	14	1·55
16	1·72	1	1·78	1	1·71	15	1·38
17	1·61	2	1·72	2	1·89	16	1·44
18	2·03	3	1·34	3	2·33	17	2·32
19	1·84	4	1·82	4	1·79	18	1·73
20	2·02	5	1·62	5	2·09	19	1·62
21	2·28	6	1·67	6	1·80	20	1·40
22	1·69	7	1·44	7	1·93	21	1·29
23	1·40	8	2·11	8	2·01	22	1·57
24	1·87	9	1·66	9	1·90	23	1·81
25	1·78	10	1·32	10	1·90	24	1·22
26	1·84	11	1·40	11	1·57	25	1·44
27	1·69	12	1·75	12	1·48	26	1·43
28	1·75	13	1·47	13	1·85	27	1·48
29	1·65	14	1·48				

TABLE XIII.—Mean Difference of a Single Observation of the Magnetic Declination from the Monthly Mean at the corresponding Hour, for each Hour in each Month of 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
12	3·12	2·61	1·88	2·17	2·31	0·86	1·64	2·06	2·59	2·33	1·34	1·58	2·04
13	3·52	2·65	3·03	2·20	2·21	1·14	1·49	2·23	1·98	2·10	1·13	1·59	2·11
14	2·35	1·82	2·10	5·13	1·36	1·04	1·59	2·29	2·41	2·04	1·66	1·11	2·07
15	3·18	1·21	2·44	2·62	1·66	1·11	1·29	1·92	2·42	1·83	1·58	1·02	1·86
16	2·06	1·36	1·99	1·50	0·95	1·27	1·95	1·41	1·68	1·03	1·36	1·45	1·50
17	1·29	1·09	1·46	1·56	1·27	1·38	2·47	1·09	1·98	1·36	0·83	0·72	1·37
18	1·41	1·38	0·95	1·28	1·13	1·28	1·93	1·38	2·57	1·37	1·17	1·11	1·41
19	1·56	0·71	0·96	1·35	1·22	1·32	1·58	2·30	2·07	1·34	1·09	0·99	1·37
20	1·56	1·28	1·41	0·93	1·83	1·50	1·52	3·13	2·81	1·45	1·50	1·23	1·68
21	1·34	1·33	1·57	0·84	1·44	1·47	1·86	2·37	2·02	1·80	2·15	1·31	1·62
22	1·27	1·26	1·28	0·87	1·53	1·35	1·57	1·88	1·69	1·49	1·93	1·37	1·46
23	1·40	1·60	1·28	0·83	1·73	1·78	1·45	1·46	1·52	1·53	1·55	1·65	1·48
0	1·40	1·58	1·24	1·34	1·77	1·40	1·30	1·46	1·48	1·47	1·97	1·80	1·52
1	1·81	1·89	1·39	1·48	2·02	1·54	1·46	2·03	1·59	1·85	2·00	2·10	1·76
2	1·77	1·47	1·46	1·52	2·22	1·47	1·30	1·94	1·53	1·96	2·04	1·88	1·71
3	1·55	2·34	1·37	1·60	1·75	1·70	1·38	1·94	1·87	1·81	1·82	2·02	1·76
4	1·20	1·67	1·24	1·37	1·71	1·42	1·10	1·69	1·54	1·33	2·52	1·58	1·53
5	1·64	1·90	1·70	1·16	1·10	1·23	0·91	1·17	1·10	1·23	2·67	1·73	1·46
6	1·52	3·40	2·64	1·50	0·87	0·78	0·96	2·55	2·43	0·66	1·33	3·45	1·84
7	2·46	3·02	1·95	1·47	0·78	0·75	0·92	1·30	2·38	0·64	2·38	1·53	1·63
8	1·96	2·52	1·64	2·20	0·92	0·60	1·02	0·89	2·50	0·82	1·48	2·39	1·58
9	2·79	2·46	3·25	1·60	1·22	0·70	1·36	2·57	2·65	2·36	1·67	1·94	2·05
10	2·62	1·59	2·55	1·21	0·88	0·79	0·68	1·99	2·23	2·80	2·90	1·93	1·85
11	3·68	1·39	1·55	1·39	1·26	0·92	1·10	1·63	2·40	3·20	1·84	1·71	1·84

TABLE XIV.—Number of Positive and Negative Differences which occur between the limits of successive Minutes, for each Month, and for the Year 1845.

Month.		0′ to 1′.	1′ to 2′.	2′ to 3′.	3′ to 4′.	4′ to 5′.	5′ to 6′.	6′ to 7′.	7′ to 8′.	8′ to 9′.	9′ to 10′.	10′ to 15′.	15′ to 20′.	20′ to 25′.	25′ to 30′.	Above 30′.
Jan.	+	121	90	92	27	11	5	1	2	2	2	1	…	…	…	…
	−	130	85	33	11	5	4	4	5	5	2	4	3	…	3	…
Feb.	+	114	107	41	16	11	9	2	2	1	…	2	…	…	…	…
	−	120	87	22	15	6	5	2	3	2	2	3	2	2	…	…
March	+	135	115	49	27	4	3	4	2	2	…	1	…	…	…	…
	−	126	64	42	13	11	6	7	8	2	…	2	1	…	…	…
April	+	146	112	44	23	7	5	3	…	…	…	1	…	…	…	…
	−	147	70	34	12	2	3	5	1	1	2	3	1	1	…	1
May	+	171	111	35	14	3	3	1	2	1	1	3	…	…	…	…
	−	134	83	43	27	6	4	3	1	…	…	2	…	…	…	…
June	+	160	72	27	15	7	3	2	1	…	…	…	…	…	…	…
	−	162	97	40	10	3	…	1	…	…	…	…	…	…	…	…
July	+	147	124	29	5	4	1	1	1	3	…	4	1	…	…	…
	−	163	94	35	20	9	2	1	1	1	…	2	…	…	…	…
Aug.	+	120	120	31	18	10	8	8	2	3	1	1	1	…	…	…
	−	115	86	42	32	8	7	3	3	…	…	3	1	1	…	…
Sept.	+	97	108	61	32	9	3	4	1	7	…	2	…	…	…	…
	−	108	72	65	24	8	2	9	3	2	…	5	1	…	1	…
Oct.	+	123	93	46	24	8	5	3	2	1	1	3	…	…	…	…
	−	168	98	42	13	2	3	3	1	3	2	2	…	2	…	…
Nov.	+	120	78	43	19	7	8	4	2	3	…	4	…	…	…	…
	−	126	98	41	27	8	3	2	2	1	2	2	…	…	…	…
Dec.	+	147	110	37	19	5	4	5	1	3	1	…	1	…	…	…
	−	153	108	20	6	7	4	5	3	1	1	2	5	…	…	…
Year	+	1601	1240	535	239	86	57	38	18	26	6	22	3	…	…	…
	−	1652	1042	459	210	75	43	45	31	18	11	30	14	6	4	1

TABLE XV.—Number of Positive and Negative Differences which occur between the limits of successive Minutes, for each Hour in 1845.

Makerstoun Mean Time.		0′ to 1′.	1′ to 2′.	2′ to 3′.	3′ to 4′.	4′ to 5′.	5′ to 6′.	6′ to 7′.	7′ to 8′.	8′ to 9′.	9′ to 10′.	10′ to 15′.	15′ to 20′.	20′ to 25′.	25′ to 30′.	Above 30′.
h.																
12	+	69	84	27	10	4	3	1	1	1	...	1	...	...	...	...
	−	49	25	11	2	4	3	6	2	1	1	4	3	...	1	...
13	+	72	97	24	9	2	...	2	1	...	1	2	...	...	...	...
	−	38	19	14	8	2	5	3	4	1	2	4	2	...	1	...
14	+	73	58	24	13	4	2	3	...	4	...	...	1	...	...	...
	−	54	34	13	8	7	2	3	3	4	...	2	...	...	...	1
15	+	65	50	30	14	3	3	1	2	1	...	1	...	...	...	...
	−	64	40	16	9	1	3	1	3	1	...	3	1	1	...	...
16	+	76	40	16	2	4	5	2	...	2	...	2	...	...	...	...
	−	78	50	15	10	5	3	3	...	...	...	...	...	...	...	...
17	+	83	32	10	9	3	1	1	3	1	...	...	1	...	...	...
	−	88	49	16	9	4	2	1	...	...	...	...	...	...	...	...
18	+	60	27	15	9	5	2	2	...	2	1	1	...	...	...	...
	−	96	64	18	7	3	1	...	...	...	...	...	...	...	...	...
19	+	63	22	17	8	4	4	2	...	2	...	2	...	...	...	...
	−	95	69	19	5	1	...	...	...	...	...	...	...	...	...	...
20	+	37	23	15	12	4	3	3	4	2	2	1	...	...	...	...
	−	95	69	29	11	2	1	...	...	...	...	...	...	...	...	...
21	+	57	29	11	13	8	4	3	1	1	...	2	...	...	...	...
	−	71	69	30	10	3	1	...	...	...	...	...	...	...	...	...
22	+	53	45	16	9	4	4	1	...	1	...	1	...	...	...	...
	−	83	50	32	12	...	...	...	...	...	...	...	...	...	...	...
23	+	58	50	14	10	8	2	1	...	1	...	...	...	...	...	...
	−	79	41	34	13	1	1	...	...	...	...	...	...	...	...	...
0	+	59	42	25	14	5	1	...	2	...	...	...	...	...	...	...
	−	63	59	30	12	...	1	...	...	...	...	...	...	...	...	...
1	+	52	33	28	13	7	3	2	1	1	...	1	...	...	...	...
	−	61	58	33	16	2	2	...	...	...	...	...	...	...	...	...
2	+	44	40	12	9	3	9	2	3	1	...	2	...	...	...	...
	−	81	64	26	13	3	...	...	...	...	1	...	...	...	...	...
3	+	48	39	17	13	3	7	3	...	1	2	1	...	...	...	...
	−	83	52	28	8	2	1	3	...	...	1	1	...	...	...	...
4	+	58	42	13	6	4	2	4	1	1	...	2	...	...	...	...
	−	88	57	20	7	4	1	1	1	...	1	...	...	...	...	...
5	+	88	51	19	7	...	2	1	...	1	...	2	...	...	...	...
	−	76	40	7	7	2	...	4	2	1	1	2	...	...	...	...
6	+	84	66	32	9	5	...	...	...	...	...	...	1	...	...	...
	−	62	28	5	3	2	2	3	1	2	...	3	3	1	1	...
7	+	86	71	31	7	3	...	...	...	...	...	...	...	...	...	...
	−	54	25	9	6	8	2	1	3	1	3	2	...	1	...	...
8	+	82	78	28	7	1	...	...	...	...	...	...	...	...	...	...
	−	62	17	14	5	6	4	3	2	1	...	1	2	...	...	...
9	+	79	83	41	11	...	...	1	1	...	...	...	...	...	...	...
	−	33	16	13	10	5	1	3	7	2	1	3	1	2	...	...
10	+	77	66	37	11	...	1	1	...	1	...	1	...	...	...	...
	−	48	26	14	10	3	3	6	1	3	...	2	1	1	...	...
11	+	76	72	33	14	2	1	...	...	...	...	...	...	...	...	...
	−	51	21	13	9	5	4	4	2	1	...	3	1	...	1	...

TABLE XVI.—Number of Differences in 1000 (without reference to sign) which occur between the limits of successive Minutes, for each Month, and for the Year 1845.

Month.	0′ to 1′.	1′ to 2′.	2′ to 3′.	3′ to 4′.	4′ to 5′.	5′ to 6′.	6′ to 7′.	7′ to 8′.	8′ to 9′.	9′ to 10′.	10′ to 15′.	15′ to 20′.	20′ to 25′.	25′ to 30′.	Above 30′.
January	387	270	193	59	25	14	8	11	11	6	8	5	...	5	...
February	406	337	109	54	30	24	7	9	5	3	9	3	3	...	...
March	418	287	146	64	24	14	18	16	6	...	5	2	...	...	...
April	470	292	125	56	15	13	13	2	2	3	6	2	2	...	2
May	471	299	120	63	14	11	6	5	2	2	8	...	...	...	...
June	537	282	112	42	17	5	2	...	...	...	...	...	...	...	...
July	478	336	99	39	20	5	3	3	6	...	9	2	...	...	...
August	377	330	117	80	29	24	18	8	5	2	6	3	2	...	...
September	329	288	202	90	27	8	21	6	14	...	11	2	...	2	...
October	449	295	136	57	15	12	9	5	6	5	8	...	3	...	...
November	410	293	140	77	25	18	10	7	7	3	10	...	...	...	...
December	463	336	88	39	19	12	15	6	6	3	3	9	...	...	...
Year	433	304	132	60	21	13	11	7	6	2	7	2	1	1	...

TABLE XVII.—Number of Differences in 1000 (without reference to sign) which occur between the limits of successive Minutes, for each Hour in 1845.

Mak. Mean Time.	0′ to 1′.	1′ to 2′.	2′ to 3′.	3′ to 4′.	4′ to 5′.	5′ to 6′.	6′ to 7′.	7′ to 8′.	8′ to 9′.	9′ to 10′.	10′ to 15′.	15′ to 20′.	20′ to 25′.	25′ to 30′.	Above 30′.
h.															
12	377	348	121	38	26	19	22	10	6	3	16	10	...	3	...
13	351	371	121	54	13	16	16	16	3	10	19	6	...	3	...
14	406	294	118	67	35	13	19	10	26	...	6	3	...	...	3
15	412	288	147	73	13	19	6	16	6	...	13	3	3	...	...
16	492	288	99	38	29	26	16	...	6	...	6	...	...	...	...
17	546	259	83	58	22	10	6	10	3	...	...	3	...	...	...
18	498	291	105	51	26	10	6	...	6	3	3	...	...	...	...
19	505	291	115	42	16	13	6	...	6	...	6	...	...	...	...
20	422	294	141	73	19	13	10	13	6	6	3	...	...	...	...
21	409	313	131	73	35	16	10	3	3	...	6	...	...	...	...
22	441	304	153	67	13	13	3	...	3	...	3	...	...	...	...
23	438	291	153	73	29	10	3	...	3	...	...	...	...	...	...
0	390	323	176	83	16	6	...	6	...	...	...	...	...	...	...
1	361	291	195	93	29	16	6	3	3	...	3	...	...	...	...
2	399	332	121	70	19	29	6	10	3	3	6	...	...	...	...
3	419	291	144	67	16	26	19	...	3	10	6	...	...	...	...
4	466	316	105	42	26	10	16	6	3	3	6	...	...	...	...
5	524	291	83	45	6	6	16	6	6	3	13	...	...	...	...
6	466	300	118	38	22	6	10	3	6	...	10	13	3	3	...
7	447	307	128	42	35	6	3	10	3	10	6	...	3	...	...
8	460	304	134	38	22	13	10	6	3	...	3	6	...	...	...
9	358	316	173	67	16	3	13	26	6	3	10	3	6	...	...
10	399	294	163	67	10	13	22	3	13	...	10	3	3	...	...
11	406	297	147	73	22	16	13	6	3	...	10	3	...	3	...

TABLE XVIII.—Mean Values of the Variations of the Horizontal Component of Magnetic Force, the whole Horizontal Component being Unity, for each Civil Week-Day and Week of 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	4476	4890	4756	5030	4479	[5555]	5503	5999	4997	5167	5061	6035
2	4831	[4903]	[5031]	5306	4827	5629	5638	5296	4423	5426	[5548]	6048
3	5184	5141	5158	5114	4882	5471	5607	[5364]	4876	5194	5456	6497
4	5307	5096	5352	5025	[4927]	5792	5897	4980	4759	5405	5407	3591
5	[5368]	5193	5326	5034	5134	5593	5880	5107	5118	[5492]	5365	5053
6	5573	4385	5327	[5144]	5083	5748	[5701]	5120	5005	5610	5828	5412
7	5645	4984	5523	5249	5155	5809	5824	5383	[5028]	5618	5404	[5359]
8	5669	4987	5279	5067	5429	[5772]	5677	5103	4739	5701	5782	5743
9	4095	[4938]	[5248]	5373	5468	5699	5320	5300	5127	5389	[5841]	6160
10	3605	5005	5030	5433	5436	6199	5477	[5424]	5422	4445	5996	6278
11	4970	5086	5005	5260	[5520]	5586	5438	5352	5372	5193	6023	6334
12	[4686]	5179	5324	5506	5610	5100	5768	5341	5347	[5330]	6014	5996
13	4812	5366	5162	[4625]	5625	4999	[5682]	6063	5268	5695	6187	5106
14	5309	5314	5082	2008	5552	5449	5790	5886	[5340]	5663	6238	[5707]
15	5327	5317	4957	4714	5460	[5322]	5880	5685	5218	5597	6311	5564
16	5166	[5367]	[4981]	4829	5432	5586	5739	5390	5501	5256	[5841]	5670
17	5383	5383	4833	4784	5449	5456	5771	[5467]	5334	5646	5460	5575
18	5230	5365	5113	5124	[5320]	5340	5566	4932	4763	5737	5309	5600
19	[4971]	5456	4742	5019	4789	5744	5853	5390	4761	[5316]	5544	6065
20	3602	5904	4803	[4831]	5548	5853	[5669]	5517	4719	5762	5897	6289
21	5198	4718	4847	4332	5244	5663	5373	5375	[5243]	4585	5912	[6209]
22	5247	4663	4803	4567	5404	[5774]	5502	5806	5356	4908	5998	6486
23	5019	[4762]	[4707]	5158	5569	5719	5947	5516	5632	5412	[6165]	6506
24	4637	4312	4719	5407	5029	5760	5869	[5543]	6226	5396	5991	6306
25	4883	4479	4186	4960	[5520]	5905	4326	5670	4704	5144	6558	6481
26	[4955]	4498	4886	5054	5470	5401	5109	5947	4556	[5566]	6632	6525
27	5039	4886	4416	[4866]	5715	5986	[5221]	4942	4700	5697	6579	6213
28	5033	4708	5004	4305	5933	5705	5222	5403	[4869]	6052	5810	[6163]
29	5121		4917	4452	5902	[5691]	5201	5842	4904	5695	5498	6244
30	4542		[4971]	5022	5638	5912	5601	4246	5183	6062	[6068]	5897
31	4557		5156		4900		5683	[4964]		5940		5617

TABLE XIX.—Mean Variations of the Horizontal Component of Magnetic Force, after eliminating the Secular Change, with reference to the Moon's Age, Declination, and Distance from the Earth, for 1845.

Moon's Age.	Variations of Horizontal Component.	Moon's Age.	Variations of Horizontal Component.	After Moon farthest North.	Variations of Horizontal Component.	After Moon farthest North.	Variations of Horizontal Component.	Before and after Perigee.	Variations of Horizontal Component.	Before and after Apogee.	Variations of Horizontal Component.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0241	0	0311	0	0441	14	0497	7	0209	7	0377
16	0256	1	0239	1	0381	15	0503	6	0321	6	0186
17	0231	2	0111	2	0443	16	0510	5	0241	5	0416
18	0164	3	0265	3	0209	17	0329	4	0315	4	0393
19	0200	4	0370	4	0312	18	0000	3	0177	3	0305
20	0214	5	0135	5	0249	19	0310	2	0289	2	0437
21	0118	6	0291	6	0227	20	0339	1	0423	1	0344
22	0230	7	0246	7	0150	21	0394	P	0482	A	0391
23	0336	8	0000	8	0213	22	0426	1	0424	1	0230
24	0217	9	0260	9	0286	23	0370	2	0167	2	0095
25	0199	10	0399	10	0258	24	0429	3	0000	3	0253
26	0431	11	0367	11	0391	25	0496	4	0227	4	0370
27	0370	12	0294	12	0332	26	0486	5	0358	5	0171
28	0409	13	0346	13	0331	27	0464	6	0311	6	0255
29	0372	14	0350					7	0234	7	0294

TABLE XX.—Diurnal Range of the Horizontal Component of Magnetic Force for each Civil Day, as deduced from the Hourly Observations, with the Mean for each Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	0157	0203	0174	0336	0602	[0377]	0435	0420	0476	0281	0533	0148
2	0151	[0218]	[0222]	0290	0252	0242	0472	0386	0588	0328	[0299]	0249
3	0081	0183	0220	0426	0358	0351	0354	[0477]	0487	0309	0260	3538
4	0073	0164	0136	0417	[0411]	0346	0368	0745	0889	0336	0221	1193
5	[0119]	0252	0172	0431	0409	0438	0323	0448	0407	[0341]	0343	0262
6	0095	0370	0193	[0434]	0400	0384	[0377]	0445	0416	0445	0200	0221
7	0225	0182	0227	0473	0448	0427	0269	0340	[0506]	0312	0358	[0349]
8	0088	0134	0269	0386	0412	[0446]	0582	0508	0540	0316	0150	0146
9	1687	[0215]	[0232]	0472	0447	0526	0368	0427	0468	0727	[0203]	0123
10	1375	0221	0315	0307	0405	0514	0421	[0395]	0316	0693	0127	0150
11	0169	0143	0214	0344	[0416]	0385	0451	0370	0347	0308	0210	0130
12	[0661]	0241	0172	0347	0339	0454	0398	0353	0399	[0401]	0171	0231
13	0230	0325	0244	[0872]	0427	0340	[0403]	0374	0423	0265	0153	0336
14	0249	0127	0346	3542	0469	0367	0477	0392	[0375]	0207	0154	[0245]
15	0259	0105	0351	0398	0543	[0377]	0361	0699	0319	0209	0161	0392
16	0126	[0176]	[0340]	0297	0799	0316	0311	0521	0319	0311	[0260]	0150
17	0203	0214	0323	0351	0609	0374	0377	[0513]	0445	0378	0654	0230
18	0218	0118	0447	0413	[0578]	0414	0364	0445	0545	0328	0245	0300
19	[0479]	0167	0332	0683	0599	0356	0377	0503	0326	[0359]	0196	0101
20	1715	0375	0668	[0469]	0475	0473	[0418]	0519	0336	0276	0141	0115
21	0106	0360	0389	0540	0441	0444	0493	0475	[0396]	0405	0188	[0157]
22	0504	0378	0307	0416	0493	[0401]	0434	0402	0308	0455	0302	0143
23	0335	[0439]	[0488]	0409	0386	0438	0462	0337	0364	0213	[0182]	0153
24	0452	0627	0559	0599	0573	0431	0479	[0388]	0496	0232	0153	0132
25	0378	0406	0528	0619	[0404]	0266	0813	0360	0872	0335	0210	0143
26	[0473]	0490	0475	0571	0312	0428	0344	0444	0368	[0203]	0099	0119
27	0479	0360	0487	[0588]	0337	0349	[0448]	0308	0571	0158	0139	0230
28	0361	0269	0274	0875	0321	0473	0389	0374	[0436]	0133	0508	[0197]
29	0833		0384	0384	0314	[0441]	0337	0770	0266	0146	0323	0172
30	0277		[0347]	0480	0585	0490	0329	0588	0256	0182	[0817]	0370
31	0231		0311		0427		0419	[0547]		0256		0148

TABLE XXI.—Means of the Diurnal Ranges of the Horizontal Component of Magnetic Force, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	3538	0	3310	0	3481	14	3731
16	3976	1	5104	1	4383	15	3281
17	3895	2	4401	2	3637	16	3216
18	4513	3	3537	3	6304	17	7364
19	3945	4	6065	4	3565	18	4982
20	3485	5	3967	5	4209	19	3286
21	4553	6	3315	6	3890	20	3433
22	3444	7	3822	7	4159	21	3301
23	3161	8	5964	8	4008	22	3135
24	3582	9	3205	9	3937	23	3422
25	2996	10	3396	10	3911	24	2731
26	3125	11	3394	11	3126	25	3276
27	2875	12	4643	12	3486	26	3119
28	2950	13	3393	13	3461	27	3194
29	3346	14	3536				

TABLE XXII.—Hourly Means of the Scale Readings of the Bifilar Magnetometer, corrected for Temperature, for each Month in 1845.

Mean Time. Gött.	Mean Time. Mak.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	h.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
13	12	531·97	535·40	537·80	535·40	539·33	542·27	541·59	541·57	536·77	539·26	541·97	538·78	538·51
14	13	531·27	534·91	534·51	533·75	538·18	540·78	539·92	539·37	538·01	540·23	542·76	539·54	537·77
15	14	526·11	533·87	532·13	526·60	537·21	539·95	539·07	537·89	535·62	539·81	542·87	541·01	536·01
16	15	533·93	533·95	535·32	534·97	537·07	539·57	538·84	538·85	536·65	541·74	543·99	541·93	538·07
17	16	535·94	535·63	533·77	533·65	536·85	539·49	537·58	538·95	536·96	542·74	544·91	543·86	538·36
18	17	537·67	536·03	536·24	535·38	535·54	537·68	536·07	537·22	538·12	542·07	545·64	545·51	538·60
19	18	538·25	537·63	536·03	534·45	534·76	535·72	535·00	534·65	535·81	541·46	546·32	546·32	538·03
20	19	538·55	537·30	534·73	532·88	530·52	532·90	532·82	530·03	530·13	540·21	544·91	544·58	535·80
21	20	536·89	535·91	530·90	527·70	526·57	529·20	529·00	526·02	526·43	535·22	540·36	543·52	532·31
22	21	536·46	532·50	528·22	522·76	524·59	526·90	526·68	523·63	523·59	530·66	535·61	541·06	529·39
23	22	534·06	531·56	525·01	520·52	524·77	525·94	526·04	524·09	521·87	529·50	535·74	538·49	528·13
0	23	535·25	531·93	527·75	522·09	526·59	529·37	529·88	527·32	526·60	530·20	535·34	536·76	529·92
1	0	535·72	533·43	531·71	525·44	530·88	535·78	533·73	533·11	531·47	532·61	538·35	537·72	533·33
2	1	537·44	535·52	533·96	530·97	536·34	540·03	538·20	539·80	537·02	537·59	540·99	540·44	537·36
3	2	536·70	537·34	539·03	536·23	540·00	543·74	542·86	541·36	538·58	538·91	542·10	542·14	539·91
4	3	536·92	538·76	540·26	540·35	544·30	546·29	546·43	546·13	540·49	540·77	543·11	542·97	542·23
5	4	536·84	537·56	541·06	543·61	548·14	547·55	548·13	547·30	541·90	540·72	542·24	544·45	543·29
6	5	536·94	537·43	540·32	545·40	549·39	549·32	549·89	547·73	543·10	541·30	543·64	545·01	544·12
7	6	536·80	537·70	540·37	546·13	550·47	550·32	552·12	547·21	545·31	542·82	543·06	549·94	545·18
8	7	535·31	538·17	540·63	545·44	549·24	550·64	549·97	548·39	543·89	542·91	542·25	546·16	544·41
9	8	535·94	537·82	538·25	542·56	546·57	548·64	549·39	545·73	540·40	542·43	541·90	539·68	542·44
10	9	536·04	537·64	540·11	541·40	544·59	546·88	545·80	544·00	541·83	542·46	541·43	540·22	541·86
11	10	533·37	535·03	538·45	540·88	542·35	545·34	543·12	543·46	539·66	540·61	541·70	540·25	540·35
12	11	533·00	536·35	538·67	539·69	541·07	543·26	543·19	543·18	540·20	539·99	541·70	540·18	540·04

TABLE XXIII.—Diurnal Variations of the Horizontal Component of Magnetic Force in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12	0820	0538	1791	2083	2064	2286	2177	2512	2086	1366	0928	0283	1453
13	0722	0469	1330	1852	1903	2078	1943	2204	2260	1502	1039	0389	1350
14	0000	0323	0997	0851	1767	1961	1824	1996	1925	1443	1054	0595	1103
15	1095	0335	1443	2023	1747	1908	1798	2131	2069	1714	1211	0724	1392
16	1376	0570	1226	1838	1716	1897	1616	2145	2113	1854	1340	0994	1432
17	1618	0626	1572	2080	1533	1644	1404	1903	2275	1760	1442	1225	1466
18	1700	0850	1543	1950	1424	1369	1254	1543	1952	1674	1537	1338	1386
19	1742	0804	1361	1730	0830	0974	0949	0896	1156	1499	1340	1095	1074
20	1509	0609	0825	1005	0277	0456	0414	0335	0638	0801	0703	0946	0585
21	1449	0132	0449	0314	0000	0134	0090	0000	0241	0162	0038	0602	0176
22	1113	0000	0000	0000	0025	0000	0000	0064	0000	0000	0056	0242	0000
23	1280	0052	0384	0220	0280	0480	0538	0517	0662	0098	0000	0000	0251
0	1345	0262	0938	0689	0881	1378	1077	1327	1344	0435	0421	0134	0728
1	1586	0554	1253	1463	1645	1973	1702	2264	2121	1133	0791	0515	1292
2	1483	0809	1963	2199	2157	2492	2355	2482	2339	1317	0946	0753	1649
3	1513	1008	2135	2776	2759	2849	2855	3150	2607	1578	1088	0869	1974
4	1502	0840	2247	3233	3297	3025	3093	3314	2804	1571	0966	1076	2122
5	1516	0822	2143	3483	3472	3273	3339	3374	2972	1652	1162	1154	2239
6	1497	0860	2150	3585	3623	3413	3651	3301	3282	1863	1081	1845	2387
7	1288	0925	2187	3489	3451	3458	3350	3466	3083	1877	0967	1315	2279
8	1376	0876	1854	3086	3077	3178	3269	3094	2594	1810	0918	0408	2003
9	1390	0851	2114	2923	2800	2932	2766	2852	2794	1814	0853	0484	1922
10	1016	0486	1882	2850	2486	2716	2391	2776	2491	1555	0890	0488	1711
11	0965	0671	1912	2684	2307	2425	2401	2737	2566	1469	0890	0478	1667

TABLE XXIV.—List of Ten Days in each Month of 1845 upon which the Horizontal Component of Magnetic Force was least disturbed.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
3	1	3	1	2	3	3	7	5	13	3	1
4	3	4	3	5	13	10	11	6	14	6	2
6	4	5	4	6	14	11	12	9	16	8	9
7	7	6	5	7	19	15	14	10	17	10	10
8	8	7	7	8	20	16	16	11	23	12	11
13	12	8	10	10	21	17	20	12	27	13	19
15	14	10	11	23	24	21	21	16	28	14	20
16	15	11	16	26	25	22	25	20	29	15	22
21	18	12	17	27	26	28	26	22	30	24	25
31	19	13	22	29	27	31	28	29	31	28	26

TABLE XXV.—Hourly Means of the Bifilar Magnetometer Scale Readings corrected for Temperature, for the Ten Days least disturbed in each Month of 1845, corrected so that the Mean of each Ten Days equals the Monthly Mean.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
12	34·16	35·93	38·06	39·14	40·33	42·69	42·48	42·42	38·40	41·06	42·28	40·69	39·81
13	33·05	35·15	36·21	37·71	39·79	40·98	40·67	40·22	39·70	39·73	41·91	41·19	38·86
14	33·93	34·80	35·80	36·53	39·11	39·88	39·24	39·99	37·72	40·16	42·58	42·04	38·48
15	34·29	35·65	36·30	35·22	38·79	39·41	39·41	39·25	38·48	41·40	43·79	42·19	38·68
16	35·00	36·24	36·59	35·67	38·38	38·97	38·24	39·99	37·28	43·01	44·18	43·03	38·88
17	36·48	36·62	36·99	37·07	36·35	37·34	36·19	38·40	38·31	42·88	44·83	44·70	38·85
18	36·47	37·27	36·55	35·20	34·95	35·52	34·44	35·61	37·08	41·64	44·66	45·20	37·89
19	36·92	37·53	35·89	32·35	31·91	32·76	32·81	31·08	31·30	40·10	42·93	44·52	35·84
20	35·87	36·13	32·49	27·52	27·38	30·13	28·06	27·25	26·54	35·90	38·00	43·40	32·39
21	35·40	34·64	29·29	23·04	24·61	27·31	25·85	23·07	23·30	31·15	35·40	40·74	29·49
22	33·46	32·62	26·34	19·24	24·51	25·64	26·04	23·04	22·14	28·88	33·63	38·59	27·85
23	33·89	31·79	26·89	20·74	26·09	29·17	29·67	26·15	25·83	30·45	34·78	37·48	29·41
0	35·08	32·09	30·73	24·13	30·44	34·94	33·55	32·28	30·32	32·60	38·40	38·46	32·75
1	36·12	35·12	32·71	29·48	35·34	40·64	37·44	38·08	36·13	36·46	41·22	40·58	36·61
2	35·10	36·16	36·02	35·37	39·57	42·58	43·27	42·08	39·13	38·07	42·60	42·58	39·38
3	35·81	36·22	38·31	38·08	44·04	46·44	46·61	46·14	38·35	40·31	44·27	42·93	41·46
4	36·85	36·37	38·77	39·99	45·46	47·60	48·38	45·86	40·22	40·00	44·69	44·03	42·35
5	37·12	37·62	38·32	42·79	48·14	49·54	49·50	45·97	42·74	41·49	44·67	44·26	43·52
6	36·51	37·56	38·61	43·81	48·63	50·46	51·17	46·31	43·72	42·25	43·98	44·21	43·94
7	35·22	36·99	39·87	43·88	47·37	50·56	50·53	46·91	43·47	42·27	43·55	43·10	43·65
8	34·97	37·07	38·32	41·34	45·72	49·16	49·11	45·76	42·18	41·71	43·39	42·28	42·59
9	34·98	36·59	38·54	40·19	44·95	47·01	45·37	45·17	39·68	42·85	42·06	41·34	41·56
10	35·93	36·30	38·56	40·07	42·47	45·07	44·28	43·47	39·87	41·62	42·36	40·98	40·92
11	34·76	36·97	38·96	39·67	41·08	43·77	42·85	42·47	38·53	40·27	42·80	40·33	40·21

TABLE XXVI.—Mean Variations of the Horizontal Component of Magnetic Force, with reference to the Moon's Hour-Angle for each Lunation, for the Six Summer and Seven Winter Lunations, and for the whole Thirteen Lunations of 1845.

Moon's Hour-Angle.	LUNATIONS.															
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	Summer.	Winter.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
0	0697	0210	0122	1064	0441	0337	0270	0490	0475	0112	0209	0045	0364	0300	0050	0155
1	0722	0274	0412	0960	0423	0575	0276	0581	0707	0244	0039	0648	0379	0374	0187	0263
2	0760	0113	0000	1064	0421	0630	0409	0687	0363	0326	0014	1711	0402	0383	0274	0314
3	0938	0272	0300	1121	0346	0459	0448	0868	0644	0109	0140	1000	0270	0450	0231	0322
4	0626	0239	0246	1231	0269	0276	0287	0721	0493	0000	0136	0134	0118	0334	0013	0151
5	0589	0228	0179	1263	0265	0241	0421	0778	0311	0071	0084	0088	0287	0334	0017	0153
6	0665	0258	0370	1256	0203	0171	0316	0654	0399	0200	0112	0171	0000	0287	0052	0151
7	0809	0342	0339	1131	0105	0000	0218	0641	0444	0190	0097	0125	0200	0211	0099	0140
8	0469	0412	0262	0679	0031	0160	0287	0461	0515	0192	0000	0000	0074	0143	0000	0056
9	0028	0318	0116	0000	0000	0126	0216	0605	0328	0599	0231	0087	0164	0000	0019	0000
10	0000	0403	0207	1254	0246	0123	0232	0518	0353	0654	0301	0106	0175	0242	0062	0135
11	0750	0263	0410	1247	0286	0265	0286	0634	0487	0344	0280	0326	0018	0322	0140	0214
12	0529	0323	0377	1485	0416	0220	0200	0864	0287	0490	0305	0322	0265	0366	0172	0251
13	0244	0179	0339	1323	0255	0272	0330	0603	0560	0280	0486	0514	0266	0345	0129	0218
14	0574	0134	0448	1452	0434	0356	0283	0580	0381	0612	0402	0452	0312	0368	0218	0277
15	0227	0137	0347	1296	0351	0270	0251	0676	0371	0647	0445	0538	0284	0323	0174	0232
16	0816	0312	0291	1470	0413	0246	0231	0500	0158	0535	0399	0517	0214	0290	0239	0253
17	0647	0489	0420	1366	0181	0127	0169	0218	0046	0515	0318	0507	0260	0139	0250	0188
18	0400	0302	0489	1320	0267	0024	0000	0466	0059	0419	0413	0489	0248	0143	0193	0160
19	0477	0154	0329	1484	0273	0032	0025	0260	0153	0262	0406	0566	0232	0159	0145	0141
20	0479	0064	0182	1212	0213	0041	0158	0143	0085	0325	0340	0307	0206	0096	0071	0072
21	0582	0000	0202	1413	0594	0034	0097	0041	0000	0258	0482	0465	0281	0151	0123	0125
22	0538	0134	0078	1406	0214	0218	0280	0000	0109	0451	0234	0386	0097	0159	0073	0102
23	0386	0080	0148	1238	0291	0428	0269	0283	0196	0070	0206	0279	0294	0238	0008	0104
24	0678	0000	0095	1175	0190	0321	0259	0470	0263	0119	0248	0384	0391	0234	0072	0137

TABLE XXVII.—Differences between the Hourly Means of the Bifilar Scale Readings for the whole Series in each Month and those for the selected Ten Days; or Table XXII. *minus* Table XXV.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
12	−2·19	−0·53	−0·26	−3·74	−1·00	−0·42	−0·89	−0·85	−1·63	−1·80	−0·31	−1·91	−1·30
13	−1·78	−0·24	−1·70	−3·96	−1·61	−0·20	−0·75	−0·85	−1·69	+0·50	+0·85	−1·65	−1·09
14	−7·82	−0·93	−3·67	−9·93	−1·90	+0·07	−0·17	−2·10	−2·10	−0·35	+0·29	−1·03	−2·47
15	−0·36	−1·70	−0·98	−0·25	−1·72	+0·16	−0·57	−0·40	−1·83	+0·34	+0·20	−0·26	−0·61
16	+0·94	−0·61	−2·82	−2·02	−1·53	+0·52	−0·66	−1·04	−0·32	−0·27	+0·73	+0·83	−0·52
17	+1·19	−0·59	−0·75	−1·69	−0·81	+0·34	−0·12	−1·18	−0·19	−0·81	+0·81	+0·81	−0·25
18	+1·78	+0·36	−0·52	−0·75	−0·19	+0·20	+0·56	−0·96	−1·27	−0·18	+1·66	+1·12	+0·14
19	+1·63	−0·23	−1·16	+0·53	−1·39	+0·14	+0·01	−1·05	−1·17	+0·11	+1·98	+0·06	−0·04
20	+1·02	−0·22	−1·59	+0·18	−0·81	−0·93	+0·94	−1·23	−0·11	−0·68	+2·36	+0·12	−0·08
21	+1·06	−2·14	−1·07	−0·28	−0·02	−0·41	+0·83	+0·56	+0·29	−0·49	+0·21	+0·32	−0·10
22	+0·60	−1·06	−1·33	+1·28	+0·26	+0·30	0·00	+1·05	−0·27	+0·62	+2·11	−0·10	+0·28
23	+1·36	+0·14	+0·86	+1·35	+0·50	+0·20	+0·21	+1·17	+0·77	−0·25	+0·56	−0·72	+0·51
0	+0·64	+1·34	+0·98	+1·31	+0·44	+0·84	+0·18	+0·83	+1·15	+0·01	−0·05	−0·74	+0·58
1	+1·32	+0·40	+1·25	+1·49	+1·00	−0·61	+0·76	+1·72	+0·89	+1·13	−0·23	−0·14	+0·75
2	+1·60	+1·18	+3·01	+0·86	+0·43	+1·16	−0·41	−0·72	−0·55	+0·84	−0·50	−0·44	+0·53
3	+1·11	+2·54	+1·95	+2·27	+0·26	−0·15	−0·18	−0·01	+2·14	+0·46	−1·16	+0·04	+0·77
4	−0·01	+1·19	+2·29	+3·62	+2·68	−0·05	−0·25	+1·44	+1·68	+0·72	−2·45	+0·42	+0·94
5	−0·18	−0·19	+2·00	+2·61	+1·25	−0·22	+0·39	+1·76	+0·36	−0·19	−1·03	+0·75	+0·60
6	+0·29	+0·14	+1·76	+2·32	+1·84	−0·14	+0·95	+0·90	+1·59	+0·57	−0·92	+5·73	+1·24
7	+0·09	+1·18	+0·76	+1·56	+1·87	+0·08	−0·56	+1·48	+0·42	+0·64	−1·30	+3·06	+0·76
8	+0·97	+0·75	−0·07	+1·22	+0·85	−0·52	+0·28	−0·03	−1·78	+0·72	−1·49	−2·60	−0·15
9	+1·06	+1·05	+1·57	+1·21	−0·36	−0·13	+0·43	−1·17	+2·15	−0·39	−0·63	−1·12	+0·30
10	−2·56	−1·27	−0·11	+0·81	−0·12	+0·27	−1·16	−0·01	−0·21	−1·01	−0·66	−0·73	−0·57
11	−1·76	−0·62	−0·29	+0·02	−0·01	−0·51	+0·34	+0·71	+1·67	−0·28	−1·10	−0·15	−0·17

TABLE XXVIII.—Mean Difference of a Single Observation of the Bifilar Magnetometer from the Monthly Mean at the corresponding Hour, for each Civil Day and Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
1	4·12	1·97	2·12	1·92	6·86	[4·15]	4·23	5·14	4·31	2·49	7·55	2·04
2	2·81	[2·97]	[2·89]	3·39	4·43	3·55	3·30	3·49	6·07	2·58	[4·54]	2·43
3	2·09	1·78	2·29	3·71	3·68	2·81	1·34	[4·28]	3·45	3·19	3·28	24·36
4	2·88	2·32	2·90	5·39	[3·71]	5·00	2·37	6·92	5·61	1·66	3·86	17·03
5	[3·92]	3·78	2·90	2·42	2·24	2·99	3·50	3·56	3·23	[2·66]	4·22	6·06
6	4·52	4·73	2·72	[3·60]	2·20	2·87	[2·69]	3·70	2·85	3·92	1·99	3·84
7	6·04	2·44	4·00	3·06	2·83	2·75	3·67	2·20	[3·97]	2·39	4·30	[5·90]
8	5·20	1·59	2·99	3·13	1·66	[3·02]	2·48	4·16	4·81	2·20	1·59	2·65
9	14·28	[2·67]	[2·70]	3·87	2·55	3·08	2·77	2·95	4·31	5·86	[2·32]	2·52
10	11·05	2·42	2·17	4·46	2·48	4·32	1·54	[3·18]	3·03	7·63	1·88	3·28
11	1·72	1·81	1·87	3·51	[2·88]	2·10	2·22	2·28	3·63	3·35	1·91	3·32
12	[6·36]	3·04	2·44	4·75	3·29	3·95	3·10	2·67	4·03	[3·87]	2·28	3·09
13	3·20	3·07	2·90	[6·84]	3·34	4·60	[2·55]	4·85	3·50	1·85	2·65	6·14
14	4·19	2·32	4·86	22·47	3·98	2·99	2·87	3·44	[3·33]	2·12	2·98	[3·98]
15	3·70	2·65	2·99	3·07	3·90	[3·19]	2·63	5·45	1·72	2·42	3·45	5·64
16	2·36	[3·00]	[3·52]	2·81	5·20	2·13	2·93	3·33	3·81	2·43	[4·11]	2·38
17	4·21	4·19	3·55	2·35	3·67	2·76	2·05	[3·88]	3·30	3·22	7·65	3·29
18	3·93	2·52	2·92	4·55	[4·00]	2·74	2·75	4·84	5·43	3·85	4·97	2·98
19	[5·11]	3·25	3·90	5·53	5·43	1·75	3·35	2·92	4·15	[4·08]	2·98	2·41
20	11·75	7·02	5·11	[3·94]	3·20	3·14	[2·80]	3·32	3·46	3·87	1·68	3·02
21	2·76	4·80	2·64	5·00	2·60	1·71	3·00	2·91	[4·65]	6·32	2·62	[3·63]
22	5·63	3·89	2·43	3·47	3·82	[2·30]	1·87	3·20	2·05	4·80	1·98	4·50
23	4·52	[6·22]	[4·50]	2·75	2·47	2·71	3·81	3·85	4·36	1·00	[3·18]	5·30
24	5·47	8·52	4·94	4·65	3·86	2·01	5·43	[3·74]	8·27	2·71	1·97	3·57
25	4·23	7·06	7·39	3·91	[3·30]	2·48	10·76	3·36	9·50	3·86	5·26	4·46
26	[5·03]	6·04	4·52	3·50	2·38	2·59	3·75	5·50	5·03	[2·78]	5·59	4·58
27	4·84	3·55	5·90	[4·86]	3·03	3·03	[4·60]	3·63	6·12	2·38	5·33	4·27
28	5·61	3·59	2·52	7·86	4·24	3·66	2·60	2·48	[5·08]	4·40	3·59	[4·13]
29	5·50		3·11	5·17	4·03	[3·41]	2·67	8·27	3·97	2·35	3·84	3·12
30	4·06		[3·23]	4·07	4·80	3·63	2·37	8·75	3·40	4·29	[6·93]	5·90
31	3·90		2·57		4·74		2·87	[5·55]		4·07		2·43

TABLE XXIX.—Mean Difference of a Single Observation of the Bifilar Magnetometer from the Monthly Mean at the corresponding Hour, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Difference.	Moon's Age.	Mean Difference.	After Moon farthest North.	Mean Difference.	After Moon farthest North.	Mean Difference.
Day.	Sc. Div.	Day.	Sc. Div.	Day.	Sc. Div.	Day.	Sc. Div.
15	3·61	0	3·61	0	3·30	14	3·78
16	3·44	1	4·86	1	4·21	15	3·08
17	4·03	2	3·74	2	4·09	16	3·32
18	4·48	3	3·11	3	5·88	17	6·20
19	4·09	4	4·96	4	4·01	18	5·36
20	4·28	5	4·44	5	4·37	19	3·62
21	4·78	6	3·61	6	3·54	20	3·50
22	3·98	7	3·51	7	4·74	21	3·37
23	4·05	8	5·41	8	4·09	22	3·24
24	3·72	9	3·37	9	4·37	23	3·71
25	3·41	10	3·38	10	4·24	24	3·07
26	4·04	11	3·37	11	3·42	25	3·36
27	4·31	12	4·14	12	3·29	26	3·71
28	3·64	13	3·21	13	3·53	27	3·61
29	3·76	14	3·63				

TABLE XXX.—Mean Difference of a Single Observation of the Bifilar Magnetometer from the Monthly Mean at the corresponding Hour, for each Hour in each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
12	5·82	4·31	3·59	8·02	3·91	2·04	2·53	3·40	5·72	5·62	2·52	6·94	4·54
13	6·11	4·86	4·03	8·93	3·57	2·70	2·68	3·60	4·51	3·20	2·63	6·32	4·43
14	14·29	4·37	6·14	18·24	3·44	2·47	2·08	4·87	4·11	3·30	2·23	5·19	5·89
15	4·46	4·00	3·67	4·38	4·34	2·84	2·89	3·38	4·05	2·50	2·44	4·48	3·62
16	4·31	3·05	5·29	5·14	3·19	2·80	3·69	2·63	3·78	2·61	2·80	3·28	3·55
17	3·50	3·63	3·27	3·90	3·55	2·07	2·65	3·42	4·48	3·03	2·46	3·87	3·32
18	2·63	2·93	2·42	3·61	3·81	2·27	2·92	3·77	4·89	3·30	2·94	3·24	3·23
19	2·95	3·10	3·10	3·38	4·62	2·60	2·81	4·35	5·48	1·99	4·17	3·04	3·47
20	3·19	3·28	3·58	3·42	4·41	3·00	3·46	5·22	5·58	3·43	3·49	3·30	3·78
21	3·80	5·59	2·95	3·53	3·25	3·10	3·12	4·38	3·49	3·47	4·99	3·84	3·79
22	4·73	3·62	3·65	3·72	2·58	3·61	4·49	5·12	4·51	2·89	3·82	3·88	3·88
23	4·10	3·40	2·56	4·16	3·46	3·94	4·57	5·05	4·19	4·29	4·64	4·39	4·06
0	4·79	4·77	2·80	2·98	3·70	4·04	3·58	4·90	3·32	4·07	3·61	5·43	4·00
1	3·82	3·52	2·41	3·67	3·30	3·35	4·33	5·70	3·77	4·48	3·65	4·11	3·84
2	3·94	2·90	2·39	4·08	4·03	3·91	3·31	6·50	4·80	3·60	3·93	3·96	3·95
3	2·53	2·99	2·27	4·42	4·12	3·76	3·98	6·36	4·77	3·20	2·73	3·21	3·70
4	3·33	2·90	4·42	4·61	4·66	3·56	2·66	4·77	5·31	3·13	4·73	3·53	3·97
5	3·63	3·08	1·77	2·93	3·68	3·80	3·65	2·97	3·16	2·68	3·82	4·09	3·27
6	3·43	4·22	3·00	2·27	3·55	3·50	2·98	2·22	2·32	2·71	3·70	13·27	3·93
7	5·11	2·55	3·22	2·54	3·04	3·28	3·17	2·62	4·06	2·53	4·76	6·62	3·62
8	4·53	3·42	4·02	3·63	2·61	2·05	3·00	3·33	5·73	2·20	4·69	6·69	3·82
9	7·32	4·39	4·19	3·01	3·19	2·34	2·61	4·34	3·38	3·29	4·65	5·71	4·03
10	8·07	3·82	3·77	3·80	2·74	2·20	2·99	2·83	4·91	4·54	3·55	5·82	4·09
11	9·25	3·66	3·33	3·17	3·40	3·09	2·52	3·20	4·39	5·00	2·92	5·41	4·11

TABLE XXXI.—Mean Values of the Variations of the Vertical Component of Magnetic Force, the whole Vertical Component being Unity, for each Civil Week-Day and Week of 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0.00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	6201	5760	5601	5468	4717	[5100]	4573	4771	4489	4493	4319	4264
2	6150	[5786]	[5555]	5401	5305	5082	4912	4369	4505	4326	[4398]	4295
3	6089	5774	5560	5517	5275	5090	4813	[4626]	4905	4475	4330	5219
4	6014	5712	5525	5492	[5262]	5262	4883	4693	4842	4381	4535	4683
5	[6036]	5993	5524	5475	5425	5164	4737	4635	4744	[4415]	4766	4703
6	5983	5823	5478	[5481]	5419	5061	[4746]	4651	4843	4523	4436	4577
7	5977	5712	5487	5460	5432	5056	4685	4662	[4698]	4427	4264	[4547]
8	6001	5708	5525	5412	5462	[5063]	4694	4525	4673	4361	4150	4535
9	5977	[5710]	[5520]	5533	5329	5019	4662	4654	4581	4262	[4294]	4419
10	6068	5643	5525	5378	5279	5011	4743	[4701]	4504	4297	4359	4365
11	6032	5677	5569	5481	[5199]	5066	4766	4812	4625	4478	4195	4295
12	[5987]	5698	5536	5523	5001	4980	4936	4760	4566	[4283]	4360	4317
13	6018	5582	5528	[5324]	5057	4996	[4829]	4793	4543	4376	4423	4506
14	5957	5588	5507	4848	5069	4957	4897	4687	[4582]	4155	4398	[4315]
15	5872	5593	5455	5325	5119	[5083]	4892	4800	4638	4131	4381	4315
16	5912	[5562]	[5472]	5387	5158	5171	4739	4887	4575	4267	[4379]	4213
17	5955	5587	5356	5431	5194	5187	4732	[4732]	4548	4288	4405	4247
18	5856	5542	5474	5458	[5149]	5210	4648	4537	4168	4237	4392	4333
19	[5750]	5478	5511	5245	4905	4881	4620	4724	4345	[4237]	4273	4322
20	5131	5450	5424	[5368]	5318	4895	[4728]	4756	4543	4214	4200	4256
21	5815	5562	5418	5330	5202	4816	4764	4737	[4422]	4287	4326	[4249]
22	5834	5580	5322	5384	5227	[4948]	4759	4758	4474	4128	4408	4239
23	5887	[5464]	[5387]	5359	5162	5051	4845	4567	4584	4299	[4307]	4187
24	5757	5320	5391	5407	5219	4988	4918	[4646]	4418	4414	4453	4155
25	6016	5387	5282	5462	[5226]	5055	4249	4508	4301	4291	4370	3974
26	[5846]	5484	5488	5252	5259	4991	4681	4646	4340	[4304]	4083	3919
27	5853	5531	5438	[5245]	5274	4986	[4675]	4662	4435	4413	3906	4029
28	5909	5588	5422	4966	5218	5047	4715	4555	[4379]	4236	3980	[4011]
29	5654		5509	5142	5111	[4891]	4769	4326	4381	4174	3967	4122
30	5766		[5457]	5243	5084	4837	4716	4253	4322	4159	[4272]	3975
31	5711		5502		4970		4636	[4505]		4278		4048

TABLE XXXII.—Mean Variations of the Vertical Component of Magnetic Force, after Eliminating the Secular Change, with reference to the Moon's Age, Declination, and Distance from the Earth. for 1845.

Moon's Age.	Variations of Vertical Component.	Moon's Age.	Variations of Vertical Component.	After Moon farthest North.	Variations of Vertical Component.	After Moon farthest North.	Variations of Vertical Component.	Before and after Perigee.	Variations of Vertical Component.	Before and after Apogee.	Variations of Vertical Component.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0051	0	0052	0	0170	14	0170	7	0133	7	0127
16	0069	1	0061	1	0106	15	0132	6	0129	6	0093
17	0044	2	0100	2	0128	16	0160	5	0115	5	0147
18	0068	3	0104	3	0000	17	0237	4	0117	4	0137
19	0109	4	0142	4	0065	18	0190	3	0101	3	0137
20	0101	5	0135	5	0123	19	0186	2	0159	2	0158
21	0045	6	0144	6	0152	20	0138	1	0138	1	0156
22	0077	7	0069	7	0134	21	0198	P	0130	A	0096
23	0103	8	0037	8	0161	22	0168	1	0168	1	0026
24	0069	9	0045	9	0158	23	0089	2	0243	2	0000
25	0021	10	0089	10	0102	24	0136	3	0193	3	0060
26	0034	11	0069	11	0166	25	0150	4	0152	4	0084
27	0000	12	0003	12	0152	26	0105	5	0166	5	0103
28	0029	13	0037	13	0160	27	0137	6	0142	6	0110
29	0025	14	0053					7	0063	7	0127

TABLE XXXIII.—Diurnal Range of the Vertical Component of Magnetic Force for each Civil Day, as deduced from the Hourly Observations, with the Mean for each Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	0398	0231	0724	0209	4177	[0580]	1075	1650	0945	0435	0984	0217
2	0243	[0585]	[0514]	0343	0190	0313	0405	1223	0835	0608	[0786]	0362
3	0089	0147	0247	0692	0224	0407	0430	[0932]	1783	0521	0611	4401
4	0165	0275	0183	0240	[0904]	0826	0313	1091	0847	0715	0525	1063
5	[0186]	1821	0254	0331	0282	0517	0420	0643	0775	[0515]	2124	0496
6	0185	0329	0135	[0417]	0256	0311	[0580]	0524	0435	0533	0465	0264
7	0290	0282	0421	0252	0298	0469	0781	0499	[0717]	0283	0790	[0382]
8	0147	0214	0314	0444	0355	[0555]	0873	0889	1099	0429	0325	0161
9	4313	[0275]	[0316]	0542	0292	0643	0664	1071	0642	2122	[0437]	0117
10	0781	0339	0555	0336	0298	0780	0609	[0579]	0502	1802	0216	0192
11	0407	0259	0253	0241	[0471]	0612	0359	0417	0451	0524	0587	0178
12	[1085]	0228	0219	0189	0451	0433	0458	0201	0936	[0873]	0241	0300
13	0407	0493	0361	[1429]	0431	0591	[0390]	0400	0520	0227	0182	0881
14	0352	0165	0715	6551	1000	0446	0269	0258	[0534]	0261	0185	[0461]
15	0248	0117	0672	0775	1237	[0440]	0242	1042	0373	0305	0167	0432
16	0335	[0234]	[0724]	0483	0746	0424	0406	0445	0223	0326	[0467]	0508
17	0251	0361	0876	0359	0446	0297	0269	[0593]	0700	0659	1141	0467
18	0145	0105	0694	0727	[0862]	0451	0248	1313	2219	0159	0698	0442
19	[1051]	0166	1029	0797	1739	0324	0378	0259	1017	[0768]	0429	0165
20	4769	0535	3361	[0649]	0346	0348	[0326]	0244	0403	0658	0279	0178
21	0471	0987	0944	1242	0659	0231	0293	0258	[0783]	1196	0190	[0210]
22	0336	1083	0758	0467	0878	[0331]	0492	0329	0279	1611	0281	0056
23	0514	[1320]	[1894]	0301	0454	0381	0278	0425	0397	0225	[0266]	0210
24	1732	1588	2383	0721	0378	0393	0951	[0464]	0383	0468	0271	0211
25	0992	1720	2629	1074	[0419]	0309	2319	0591	4499	0851	0154	0307
26	[1092]	2005	1292	0342	0204	0399	0296	0937	0904	[0395]	0421	0215
27	0923	0736	1638	[1136]	0333	0383	[0798]	0247	1659	0221	0208	0326
28	0986	0940	0420	3602	0270	0602	0497	0339	[1449]	0236	0460	[0385]
29	1403		0759	0512	0365	[0583]	0286	2689	0577	0372	0493	0240
30	0609		[0602]	0564	0530	0634	0440	2737	0621	0174	[1023]	0779
31	0426		0245		1040		0459	[1555]		0301		0441

TABLE XXXIV.—Means of the Diurnal Ranges of the Vertical Component of Magnetic Force, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0668	0	0435	0	0532	14	0572
16	0729	1	0792	1	0757	15	0348
17	0796	2	0640	2	0642	16	0424
18	0763	3	0522	3	1469	17	1566
19	0707	4	0822	4	0741	18	0573
20	0682	5	0524	5	1053	19	0505
21	0874	6	0617	6	0792	20	0677
22	0721	7	0548	7	0713	21	0315
23	0477	8	1110	8	0822	22	0434
24	0726	9	0564	9	0744	23	0659
25	0732	10	0406	10	0973	24	0368
26	0654	11	0519	11	0463	25	0426
27	0570	12	1029	12	0544	26	0460
28	0685	13	0518	13	0526	27	0471
29	0602	14	0455				

XXXV.—Hourly Means of the Micrometer Readings of the Balance Magnetometer, corrected for Temperature, for each Month, and for the Year 1845.

Mean Time.		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Gött.	Mak.													
h.	h.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
13	12	578·3	547·2	529·8	500·7	507·5	495·1	464·2	443·5	433·0	416·8	422·8	425·9	480·4
14	13	576·8	546·4	524·4	508·2	498·6	495·9	462·9	443·5	421·5	414·7	422·0	421·7	478·0
15	14	569·2	545·8	523·5	507·0	499·3	497·9	461·0	445·0	426·5	414·7	418·1	421·1	477·4
16	15	574·5	547·7	520·1	521·2	497·3	502·4	461·3	444·8	425·3	416·0	418·8	418·4	479·0
17	16	577·4	548·4	528·6	519·2	512·0	507·6	465·4	451·6	429·8	418·2	419·6	419·7	483·1
18	17	578·6	548·7	534·7	528·9	519·8	511·4	467·6	458·2	433·1	419·3	420·3	419·8	486·7
19	18	581·1	548·6	541·3	537·5	524·5	514·5	472·4	465·2	441·2	422·3	420·2	420·3	490·8
20	19	581·7	550·5	545·6	541·6	526·4	515·0	474·6	469·3	450·0	427·2	422·0	420·7	493·7
21	20	582·5	552·7	550·4	544·1	522·4	513·9	477·2	469·0	452·9	431·5	425·4	422·5	495·4
22	21	582·2	555·7	550·5	543·4	517·0	507·9	474·0	467·9	454·5	432·5	426·5	423·4	494·6
23	22	586·1	557·7	550·2	541·0	511·9	500·4	473·8	465·8	455·7	429·3	425·6	424·3	493·5
0	23	590·5	558·4	545·6	535·6	508·2	490·3	468·9	461·8	454·8	430·2	428·9	426·6	491·6
1	0	591·3	561·4	542·6	531·1	507·9	486·6	466·1	460·2	455·5	433·2	432·9	429·8	491·5
2	1	595·9	566·4	545·5	534·8	513·8	489·7	468·9	465·0	465·7	436·7	435·8	433·0	495·9
3	2	602·2	572·4	552·1	541·6	519·3	493·8	472·4	473·5	477·1	443·2	440·9	439·5	502·3
4	3	607·9	581·9	560·1	549·2	528·8	500·6	479·0	481·1	483·3	447·4	445·5	450·0	509·6
5	4	609·1	583·5	570·1	551·9	534·1	509·4	485·9	487·9	485·8	451·2	447·7	450·7	513·9
6	5	610·7	587·0	583·0	555·5	540·5	513·4	489·7	489·9	489·2	448·0	447·4	453·9	517·3
7	6	610·3	583·2	579·0	558·8	540·5	514·3	490·3	487·3	475·0	444·0	447·1	453·8	515·3
8	7	613·2	576·2	569·3	556·6	535·5	512·4	489·6	478·8	470·0	440·9	443·3	449·5	511·3
9	8	611·1	572·8	562·2	549·9	531·6	510·3	486·0	472·7	464·1	438·2	439·8	437·1	506·3
10	9	601·2	566·3	552·4	543·8	525·4	505·1	479·3	459·3	455·6	436·0	433·7	434·9	499·4
11	10	582·5	563·2	541·9	535·8	521·6	499·4	474·8	458·1	445·1	432·2	428·9	431·9	492·9
12	11	574·3	555·2	538·1	528·6	517·7	494·9	471·0	444·8	437·6	420·0	424·4	428·0	486·2

TABLE XXXVI.—Diurnal Variations of the Vertical Component of Magnetic Force in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12	0091	0014	0097	0000	0102	0085	0032	0000	0115	0021	0047	0075	0030
13	0076	0006	0043	0075	0013	0093	0019	0000	0000	0000	0039	0033	0006
14	0000	0000	0034	0063	0020	0113	0000	0015	0050	0000	0000	0027	0000
15	0053	0019	0000	0205	0000	0158	0003	0013	0038	0013	0007	0000	0016
16	0082	0026	0085	0185	0147	0210	0044	0081	0083	0035	0015	0013	0057
17	0094	0029	0146	0282	0225	0248	0066	0147	0116	0046	0022	0014	0093
18	0119	0028	0212	0368	0272	0279	0114	0217	0197	0076	0021	0019	0134
19	0125	0047	0255	0409	0291	0284	0136	0258	0285	0125	0039	0023	0163
20	0133	0069	0303	0434	0251	0273	0162	0255	0314	0168	0073	0041	0180
21	0130	0099	0304	0427	0197	0213	0130	0244	0330	0178	0084	0050	0172
22	0169	0119	0301	0403	0146	0138	0128	0223	0342	0146	0075	0059	0161
23	0213	0126	0255	0349	0109	0037	0079	0183	0333	0155	0108	0082	0142
0	0221	0156	0225	0304	0106	0000	0051	0167	0340	0185	0148	0114	0141
1	0267	0206	0254	0341	0165	0031	0079	0215	0442	0220	0177	0146	0185
2	0330	0266	0320	0409	0220	0072	0114	0300	0556	0285	0228	0211	0249
3	0387	0361	0400	0485	0315	0140	0180	0376	0618	0327	0274	0316	0322
4	0399	0377	0500	0512	0368	0228	0249	0444	0643	0365	0296	0323	0365
5	0415	0412	0629	0548	0432	0268	0287	0464	0677	0333	0293	0355	0399
6	0411	0374	0589	0581	0432	0277	0293	0438	0535	0293	0290	0354	0379
7	0440	0304	0492	0559	0382	0258	0286	0353	0485	0262	0252	0311	0339
8	0419	0270	0421	0492	0343	0237	0250	0292	0426	0235	0217	0187	0289
9	0320	0205	0323	0431	0281	0185	0183	0158	0341	0213	0156	0165	0220
10	0133	0174	0218	0351	0243	0128	0138	0116	0236	0175	0108	0135	0155
11	0051	0091	0180	0279	0204	0083	0100	0013	0161	0053	0063	0096	0088

TABLE XXXVII.—List of Days in each Month of 1845 upon which the Vertical Component of Magnetic Force was least disturbed.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
1	1	3	1	2	2	2	7	6	1	4	1
2	3	4	2	3	3	3	11	11	3	7	5
3	4	5	4	5	6	4	12	15	6	8	6
4	7	6	5	6	7	5	13	16	7	10	8
6	8	7	7	9	12	12	14	20	8	12	9
7	10	8	11	13	13	14	16	22	11	13	10
8	11	11	12	21	14	15	19	23	13	14	11
13	12	12	17	23	16	17	20	29	15	15	12
15	14	13	22	24	17	18	21		16	19	15
17	15	28	23	26	19	21	22		17	20	16
18	17	31		27	20	22	23		18	21	17
21	18			29	21	23	27		23	22	18
31	19				23	26			24	24	19, 20
					25	29			27	25	22, 23
					26	30			30	27	24, 26
					27	31				28	27, 29

TABLE XXXVIII.—Hourly Means of the Balance Magnetometer Micrometer Readings corrected for Temperature, for the least disturbed days in each Month of 1845, corrected so that the Mean of each Monthly Series equals the true Monthly Mean.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
12	588·3	559·8	542·7	526·2	513·9	496·6	468·5	454·4	441·0	421·0	424·5	428·8	488·8
13	587·9	558·3	543·6	528·0	514·6	497·4	468·4	454·4	439·9	422·0	424·3	427·9	488·9
14	587·5	556·2	545·1	531·8	516·8	499·9	470·2	456·5	444·8	423·5	422·7	426·0	490·1
15	586·3	556·8	544·8	533·3	519·5	505·2	472·0	459·0	444·7	423·1	422·7	425·0	491·0
16	585·3	557·2	545·0	533·3	523·5	510·6	476·2	463·2	446·9	423·2	422·0	424·0	492·5
17	583·3	557·5	545·7	534·5	525·5	514·6	478·1	466·1	447·3	422·5	422·3	423·7	493·4
18	584·5	556·6	546·3	536·9	525·6	517·8	479·9	469·7	451·0	423·2	422·1	425·0	494·9
19	584·9	557·1	548·0	542·1	526·8	517·6	477·6	473·1	457·5	426·8	423·6	425·4	496·7
20	586·3	557·8	550·5	545·1	522·3	517·0	477·5	470·0	459·3	429·0	427·3	427·0	497·4
21	585·3	557·9	550·0	543·9	518·3	510·3	473·3	470·2	458·7	430·6	428·0	428·1	496·2
22	587·8	559·4	448·5	541·5	512·2	501·9	473·0	465·3	456·7	428·6	428·3	428·1	494·3
23	589·5	559·1	544·0	534·1	507·3	491·7	466·3	459·2	454·0	428·4	431·3	430·1	491·2
0	589·7	560·4	540·8	527·6	503·9	488·7	462·5	457·6	449·1	428·9	435·2	432·4	489·7
1	593·4	561·7	542·1	529·8	509·4	491·3	463·2	460·3	454·8	431·9	437·5	434·3	492·5
2	596·6	564·9	545·7	535·2	515·7	494·9	466·3	465·8	464·8	438·0	440·7	439·3	497·3
3	597·9	569·3	551·8	538·7	522·6	498·9	473·6	471·8	470·1	444·5	442·0	442·9	502·0
4	598·0	570·7	556·0	540·3	526·8	504·6	480·0	476·5	469·7	448·9	441·7	441·6	504·6
5	595·7	569·8	555·9	541·1	529·6	506·4	483·4	476·2	464·8	447·4	439·9	439·8	504·2
6	595·2	568·4	553·8	542·2	529·3	507·7	484·3	471·7	459·5	443·7	438·1	439·2	502·8
7	596·6	566·4	551·6	542·9	526·2	506·5	482·8	465·7	454·9	440·2	436·3	437·2	500·6
8	595·8	565·6	551·8	540·1	523·6	505·5	480·4	462·5	453·6	436·2	435·2	435·2	498·8
9	595·4	565·1	548·1	537·3	518·8	502·0	476·1	460·4	452·3	431·4	432·3	432·3	496·0
10	591·7	562·7	545·7	533·0	515·5	498·4	472·8	458·3	445·9	428·1	430·8	432·2	492·9
11	587·9	559·6	543·1	528·3	513·4	495·8	468·7	454·7	439·7	423·1	428·3	429·3	489·3

TABLE XXXIX.—Mean Variations of the Vertical Component of Magnetic Force, with reference to the Moon's Hour-Angle, for each Lunation, for the Six Summer and Seven Winter Lunations, and for the whole Thirteen Lunations of 1845.

Moon's Hour-Angle.	Lunations.															
	1st.	2d.	3d.	4th.	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	Summer.	Winter.	Year.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
0	0168	0051	0128	0198	0189	0032	0078	0017	0218	0048	0097	0160	0048	0046	0055	0041
1	0172	0052	0077	0181	0213	0036	0100	0054	0218	0101	0097	0212	0057	0058	0065	0052
2	0176	0039	0064	0117	0208	0043	0094	0058	0248	0162	0103	0203	0051	0052	0069	0051
3	0140	0014	0028	0161	0202	0068	0094	0055	0209	0173	0070	0177	0047	0056	0048	0041
4	0079	0019	0005	0162	0164	0097	0093	0061	0198	0109	0067	0072	0048	0054	0012	0021
5	0014	0017	0000	0163	0166	0105	0081	0060	0180	0129	0042	0071	0042	0050	0000	0013
6	0040	0065	0012	0176	0135	0107	0085	0085	0139	0178	0034	0048	0036	0046	0014	0019
7	0086	0055	0042	0099	0161	0114	0066	0105	0122	0177	0030	0044	0013	0036	0019	0017
8	0091	0026	0076	0060	0217	0096	0066	0091	0101	0177	0036	0031	0018	0030	0020	0014
9	0000	0023	0126	0000	0226	0099	0066	0061	0068	0157	0056	0000	0017	0011	0009	0000
10	0017	0043	0152	0148	0243	0095	0041	0048	0090	0243	0073	0020	0020	0035	0008	0026
11	0146	0058	0175	0228	0245	0078	0046	0036	0069	0197	0095	0016	0036	0041	0058	0040
12	0144	0078	0255	0271	0239	0091	0050	0027	0000	0166	0092	0075	0034	0037	0076	0048
13	0179	0097	0233	0293	0250	0100	0049	0073	0053	0121	0075	0085	0049	0061	0075	0058
14	0215	0129	0236	0290	0262	0086	0033	0078	0060	0120	0073	0071	0052	0059	0083	0062
15	0200	0131	0245	0320	0252	0086	0033	0078	0042	0129	0084	0061	0045	0060	0083	0062
16	0187	0114	0269	0298	0248	0081	0038	0056	0032	0122	0084	0085	0044	0050	0084	0058
17	0182	0096	0268	0212	0211	0079	0029	0057	0046	0131	0089	0080	0024	0030	0079	0047
18	0209	0075	0244	0226	0146	0061	0027	0050	0062	0147	0084	0078	0029	0020	0079	0041
19	0178	0056	0219	0240	0118	0050	0005	0058	0089	0114	0057	0060	0011	0018	0054	0027
20	0157	0030	0229	0233	0000	0047	0000	0051	0122	0093	0044	0031	0008	0000	0040	0011
21	0180	0035	0167	0242	0092	0046	0015	0040	0151	0064	0000	0025	0000	0022	0022	0012
22	0221	0004	0176	0294	0185	0018	0041	0017	0156	0054	0010	0040	0005	0043	0028	0025
23	0172	0000	0126	0254	0188	0000	0049	0000	0176	0017	0036	0037	0010	0036	0012	0013
24	0162	0041	0057	0225	0126	0012	0069	0021	0203	0000	0079	0114	0016	0034	0022	0017

TABLE XL.—Differences between the Hourly Means of the Balance Micrometer Readings for the whole Series in each Month, and those for the selected Days; or Table XXXV. *minus* Table XXXVIII.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
12	−10·0	−12·6	−12·9	−25·5	− 6·4	−1·5	− 4·3	−10·9	− 8·0	−4·2	−1·7	− 2·9	− 8·4
13	−11·1	−11·9	−19·2	−19·8	−16·0	−1·5	− 5·5	−10·9	−18·4	−7·3	−2·3	− 6·2	−10·9
14	−18·3	−10·4	−21·6	−24·8	−17·5	−2·0	− 9·2	−11·5	−18·3	−8·8	−4·6	− 4·9	−12·7
15	−11·8	− 9·1	−24·7	−12·1	−22·2	−2·8	−10·7	−14·2	−19·4	−7·1	−3·9	− 6·6	−12·0
16	− 7·9	− 8·8	−16·4	−14·1	−11·5	−3·0	−10·8	−11·6	−17·1	−5·0	−2·4	− 4·3	− 9·4
17	− 4·7	− 9·0	−11·0	− 5·6	− 5·7	−3·2	−10·5	− 7·9	−14·2	−3·2	−2·0	− 3·9	− 6·7
18	− 3·4	− 8·0	− 5·0	+ 0·6	− 1·1	−3·3	− 7·5	− 4·5	− 9·8	−0·9	−1·9	− 4·7	− 4·1
19	− 3·2	− 6·6	− 2·4	− 0·5	− 0·4	−2·6	− 3·0	− 3·8	− 7·5	+0·4	−1·6	− 4·7	− 3·0
20	− 3·8	− 5·1	− 0·1	− 1·0	+ 0·1	−3·1	− 0·3	− 1·0	− 6·4	+2·5	−1·9	− 4·5	− 2·0
21	− 3·1	− 2·2	+ 0·5	− 0·5	− 1·3	−2·4	+ 0·7	− 2·3	− 4·2	+1·9	−1·5	− 4·7	− 1·6
22	− 1·7	− 1·7	+ 1·7	− 0·3	− 1·5	+ 0·8	+ 0·5	− 1·0	+0·7	−2·7	− 3·8	− 0·8	
23	+ 1·0	− 0·7	+ 1·6	+ 1·5	+ 0·9	−1·4	+ 2·6	+ 2·6	+ 0·8	+1·8	−2·4	− 3·5	+ 0·4
0	+ 1·6	+ 1·0	+ 1·8	+ 3·5	+ 4·0	−2·1	+ 3·6	+ 2·6	+ 6·4	+4·3	−2·3	− 2·6	+ 1·8
1	+ 2·5	+ 4·7	+ 3·4	+ 5·0	+ 4·4	−1·6	+ 5·7	+ 4·7	+10·9	+4·8	−1·7	− 1·3	+ 3·4
2	+ 5·6	+ 7·5	+ 6·4	+ 6·4	+ 3·6	−1·1	+ 6·1	+ 7·7	+12·3	+5·2	+0·2	+ 0·2	+ 5·0
3	+10·0	+12·6	+ 8·3	+10·5	+ 6·2	+1·7	+ 5·4	+ 9·3	+13·2	+2·9	+3·5	+ 7·1	+ 7·6
4	+11·1	+12·8	+14·1	+11·6	+ 7·3	+4·8	+ 5·9	+11·4	+16·1	+2·3	+6·0	+ 9·1	+ 9·3
5	+15·0	+17·2	+27·1	+14·4	+10·9	+7·0	+ 6·3	+13·7	+24·4	+0·6	+7·5	+14·1	+13·1
6	+15·1	+14·8	+25·2	+16·6	+11·2	+6·6	+ 6·0	+15·6	+15·5	+0·3	+9·0	+14·6	+12·5
7	+16·6	+ 9·8	+17·7	+13·7	+ 9·3	+5·9	+ 6·8	+13·1	+15·1	+0·7	+7·0	+12·3	+10·7
8	+15·3	+ 7·2	+10·4	+ 9·8	+ 8·0	+4·8	+ 5·6	+10·2	+10·5	+2·0	+4·6	+ 1·9	+ 7·5
9	+ 5·8	+ 1·2	+ 4·3	+ 6·5	+ 6·6	+3·1	+ 3·2	− 1·1	+ 3·3	+4·6	+1·4	+ 2·6	+ 3·4
10	− 9·2	+ 0·5	− 3·8	+ 2·8	+ 6·1	+1·0	+ 2·0	− 0·2	− 0·8	+4·1	−1·9	− 0·3	0·0
11	−13·6	− 4·4	− 5·0	+ 0·3	+ 4·3	−0·9	+ 2·3	− 9·9	− 2·1	−3·1	−3·9	− 1·3	− 3·1

TABLE XLI.—Mean Difference of a Single Observation of the Balance Magnetometer from the Monthly Mean at the corresponding hour, for each Civil Day and Week in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
1	29·7	14·4	15·2	12·9	65·6	[14·8]	20·4	23·7	14·7	18·3	14·6	8·3
2	24·6	[19·0]	[12·2]	8·7	13·8	7·1	17·1	31·0	30·2	5·6	[19·4]	4·8
3	18·7	17·2	13·8	15·7	11·4	8·9	11·0	[16·6]	40·2	16·7	8·4	91·9
4	13·7	11·7	13·4	13·1	[26·8]	23·2	14·3	13·2	30·8	8·5	22·8	41·4
5	[16·1]	37·8	13·5	16·9	23·3	14·1	14·2	11·2	21·7	[11·7]	47·5	38·8
6	13·9	21·6	14·5	[14·1]	22·7	4·6	[11·8]	7·9	30·9	21·3	24·8	26·1
7	11·0	11·7	14·2	10·3	24·0	6·7	10·9	6·3	[20·7]	11·8	11·2	[25·1]
8	14·5	10·3	10·6	9·2	27·0	[10·2]	9·6	12·2	20·3	6·1	15·7	22·0
9	44·5	[11·2]	[12·3]	19·6	13·6	16·2	10·6	12·9	9·8	14·9	[12·7]	14·2
10	19·4	5·5	8·6	10·6	10·8	12·3	12·8	[13·1]	10·7	29·4	6·2	8·4
11	13·6	7·9	11·8	13·4	[16·5]	7·2	3·5	16·9	12·5	16·9	11·3	11·7
12	[18·4]	10·1	14·0	16·2	19·3	8·9	19·6	14·4	13·2	[18·0]	7·0	5·7
13	12·6	7·4	8·4	[23·1]	14·9	13·2	[13·9]	15·9	8·5	8·7	11·8	20·1
14	11·2	8·6	9·4	85·6	13·6	9·3	16·6	13·0	[12·7]	20·1	10·9	[10·3]
15	9·4	9·4	10·4	6·7	18·4	[13·0]	15·2	20·2	15·7	17·9	9·2	6·6
16	9·6	[10·0]	[9·7]	6·0	13·3	13·7	15·9	24·4	15·4	4·6	[11·1]	10·6
17	11·8	7·4	11·9	12·4	12·3	15·2	4·8	[16·8]	10·7	12·1	18·2	7·4
18	9·6	10·2	8·1	14·3	[16·8]	17·8	13·5	20·1	36·6	11·9	10·7	5·6
19	[23·3]	17·0	10·2	15·6	33·0	15·4	12·0	12·0	21·5	[14·3]	5·6	8·4
20	89·4	19·2	44·0	[12·4]	14·4	15·1	[10·3]	11·4	14·9	13·2	10·9	7·2
21	10·5	16·1	17·9	12·7	9·2	21·8	4·8	14·1	[19·9]	19·6	6·3	[10·0]
22	9·2	11·2	16·2	10·3	8·5	[12·0]	12·3	11·5	11·4	24·3	10·2	10·0
23	8·4	[25·1]	[27·4]	9·3	11·4	4·4	14·2	12·6	17·1	6·5	[12·9]	12·8
24	25·7	34·4	35·9	9·0	10·0	8·7	19·6	[12·5]	17·7	10·4	14·5	16·0
25	14·8	41·0	33·7	23·1	[9·9]	6·6	58·6	14·1	69·3	14·5	11·4	34·1
26	[17·8]	28·6	16·6	12·0	9·2	6·4	6·3	13·2	19·8	[11·8]	23·9	39·6
27	10·6	8·8	16·0	[22·7]	10·0	5·7	[17·4]	9·4	15·4	10·4	40·1	28·7
28	14·8	8·3	9·9	51·2	10·3	9·8	5·2	13·7	[26·6]	15·4	32·8	[30·4]
29	32·8		11·3	21·8	12·2	[13·2]	9·5	33·2	15·4	13·6	34·0	19·3
30	13·8		[12·3]	19·2	12·2	19·8	5·3	46·7	21·3	15·9	[35·3]	34·2
31	19·4		14·9		25·5		12·5	[29·8]		7·4		26·7

TABLE XLII.—Mean Difference of a Single Observation of the Balance Magnetometer from the Monthly Mean at the corresponding hour, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Difference.	Moon's Age.	Mean Difference.	After Moon farthest North.	Mean Difference.	After Moon farthest North.	Mean Difference.
Day.	Mic. Div.	Day.	Mic. Div.	Day.	Mic. Div.	Day.	Mic. Div.
15	13·3	0	17·6	0	12·5	14	17·2
16	14·5	1	17·8	1	17·5	15	11·4
17	15·8	2	15·3	2	14·2	16	14·5
18	15·4	3	13·5	3	25·7	17	29·6
19	14·9	4	18·8	4	15·4	18	17·8
20	14·6	5	17·5	5	16·1	19	15·2
21	20·2	6	18·2	6	14·3	20	18·2
22	14·7	7	14·0	7	16·7	21	13·3
23	16·0	8	19·8	8	18·7	22	13·4
24	18·3	9	14·5	9	19·3	23	18·5
25	20·0	10	12·4	10	21·2	24	11·3
26	15·4	11	12·8	11	17·5	25	13·8
27	17·9	12	22·2	12	14·9	26	13·3
28	21·0	13	15·5	13	15·5	27	14·3
29	21·0	14	15·2				

TABLE XLIII.—Mean Difference of a Single Observation of the Balance Magnetometer from the Monthly Mean at the corresponding hour, for each Hour in each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
12	25·3	26·5	23·4	49·4	22·5	9·2	14·1	24·3	18·8	18·1	13·1	18·1	21·9
13	23·3	24·3	30·1	36·1	35·9	9·5	16·0	24·5	25·7	18·3	14·1	15·8	22·8
14	36·3	22·6	31·5	44·2	36·8	9·7	20·8	25·5	25·0	19·1	17·7	15·2	25·4
15	30·3	19·5	32·8	25·9	42·1	10·0	23·3	28·2	28·8	17·4	17·8	16·8	24·4
16	26·5	18·2	24·0	31·5	27·7	10·6	22·1	25·1	27·8	15·8	16·5	16·1	21·8
17	21·8	18·4	17·9	18·7	20·7	11·7	22·0	20·7	29·0	13·9	16·3	17·8	19·1
18	19·7	17·7	11·2	10·9	16·7	11·3	18·4	16·7	27·1	12·5	16·9	17·3	16·4
19	18·3	15·1	8·4	12·3	15·2	11·4	15·2	15·7	22·1	11·6	16·7	16·1	14·8
20	18·1	13·4	7·4	12·3	13·7	11·7	12·7	14·5	22·2	9·9	16·5	16·0	14·0
21	17·0	11·1	7·2	12·5	15·5	10·9	11·6	13·8	18·1	10·9	15·4	15·8	13·3
22	14·5	10·8	7·4	12·4	15·1	10·4	10·4	11·5	15·0	10·8	15·1	15·7	12·4
23	11·2	10·7	7·1	9·7	13·7	10·1	9·5	10·5	13·0	9·4	13·4	15·4	11·1
0	11·4	10·7	7·5	9·8	13·8	9·2	9·8	10·4	13·3	10·1	12·4	15·7	11·2
1	11·8	10·9	7·7	11·6	13·9	10·0	9·4	11·9	19·9	10·5	13·1	15·6	12·2
2	12·7	11·6	7·2	10·8	13·3	11·6	11·1	12·6	23·3	11·0	14·8	16·5	13·0
3	14·9	15·8	8·8	15·0	13·2	13·0	10·9	12·6	23·3	13·5	18·2	28·0	15·6
4	14·9	14·3	12·4	13·6	12·7	15·7	12·9	16·6	21·8	17·1	20·9	31·8	17·1
5	15·1	19·6	28·1	14·6	13·4	16·0	13·6	18·7	31·5	18·2	22·5	39·4	20·9
6	16·8	17·1	24·8	15·7	14·0	14·8	13·1	14·8	19·4	16·3	26·0	39·7	19·4
7	17·1	10·5	16·6	12·9	11·3	15·1	12·2	10·8	17·2	15·3	23·0	35·6	16·5
8	16·5	9·7	12·6	9·3	9·1	13·9	10·5	7·1	14·5	13·9	19·9	21·6	13·2
9	15·5	13·7	11·1	6·6	7·8	11·9	10·4	18·3	11·2	12·2	16·1	21·9	13·1
10	24·2	14·3	14·2	11·1	7·9	10·9	9·8	13·5	16·0	10·5	13·4	18·4	13·7
11	26·7	19·3	14·0	13·9	11·5	11·7	9·2	23·5	19·6	17·8	13·3	18·4	16·6

VARIATIONS OF MAGNETIC DIP.

TABLE XLIV.—Variations of Magnetic Dip, with reference to the Moon's Age, Declination, and Distance from the Earth, as deduced from Tables XIX. and XXXII.

Moon's Age.	Variations of Magnetic Dip.	Moon's Age.	Variations of Magnetic Dip.	After Moon farthest North.	Variations of Magnetic Dip.	After Moon farthest North.	Variations of Magnetic Dip.	Before and after Perigee.	Variations of Magnetic Dip.	Before and after Apogee.	Variations of Magnetic Dip.
Day.	′	Day.	′	Day.	′	Day.	′	Day.	′	Day.	′
15	0·215	0	0·144	0	0·114	14	0·056	7	0·287	7	0·106
16	0·219	1	0·228	1	0·110	15	0·010	6	0·166	6	0·270
17	0·219	2	0·402	2	0·068	16	0·032	5	0·235	5	0·087
18	0·313	3	0·246	3	0·178	17	0·300	4	0·160	4	0·100
19	0·318	4	0·175	4	0·139	18	0·594	3	0·287	3	0·192
20	0·295	5	0·413	5	0·265	19	0·267	2	0·231	2	0·076
21	0·337	6	0·260	6	0·318	20	0·187	1	0·069	1	0·171
22	0·254	7	0·229	7	0·379	21	0·191	P	0·000	A	0·059
23	0·171	8	0·451	8	0·342	22	0·128	1	0·100	1	0·154
24	0·259	9	0·189	9	0·263	23	0·104	2	0·445	2	0·267
25	0·228	10	0·091	10	0·234	24	0·091	3	0·567	3	0·166
26	0·000	11	0·103	11	0·162	25	0·036	4	0·288	4	0·069
27	0·028	12	0·110	12	0·209	26	0·000	5	0·167	5	0·296
28	0·018	13	0·092	13	0·218	27	0·056	6	0·199	6	0·215
29	0·052	14	0·104					7	0·188	7	0·192

TABLE XLV.—Diurnal Variations of the Magnetic Dip in 1845, as deduced from Tables XXIII. and XXXVI.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
12	0·924	0·310	0·101	0·958	1·279	1·039	1·261	0·625	0·807	0·493	0·661	1·334	0·609
13	1·010	0·373	0·524	1·276	1·353	1·264	1·491	0·945	0·507	0·330	0·537	1·180	0·692
14	1·682	0·519	0·861	2·304	1·502	1·406	1·595	1·177	0·907	0·391	0·481	0·959	0·941
15	0·598	0·526	0·362	1·233	1·502	1·508	1·631	1·034	0·745	0·123	0·325	0·797	0·658
16	0·336	0·289	0·676	1·405	1·687	1·574	1·857	1·091	0·746	0·000	0·199	0·530	0·659
17	0·097	0·234	0·380	1·254	1·959	1·876	2·100	1·411	0·612	0·103	0·100	0·291	0·661
18	0·038	0·000	0·479	1·479	2·121	2·194	2·306	1·858	1·032	0·230	0·000	0·178	0·786
19	0·000	0·068	0·713	1·750	2·758	2·610	2·646	2·573	1·951	0·463	0·224	0·435	1·142
20	0·251	0·293	1·320	2·530	3·292	3·138	3·230	3·154	2·520	1·234	0·922	0·609	1·667
21	0·310	0·821	1·712	3·242	3·524	3·410	3·534	3·491	2·950	1·909	1·625	0·976	2·085
22	0·700	0·979	2·176	3·543	3·445	3·472	3·625	3·402	3·213	2·044	1·597	1·360	2·256
23	0·572	0·932	1·729	3·258	3·141	2·867	3·015	2·890	2·515	1·951	1·689	1·635	1·976
0	0·513	0·745	1·121	2·724	2·513	1·895	2·425	2·031	1·813	1·632	1·293	1·529	1·479
1	0·310	0·493	0·824	1·957	1·780	1·308	1·804	1·106	1·111	0·942	0·938	1·166	0·938
2	0·470	0·290	0·154	1·262	1·304	0·811	1·161	0·968	1·003	0·819	0·830	0·987	0·631
3	0·511	0·182	0·059	0·741	0·777	0·511	0·710	0·352	0·788	0·591	0·730	0·975	0·370
4	0·535	0·373	0·046	0·294	0·273	0·419	0·534	0·252	0·610	0·638	0·880	0·767	0·262
5	0·537	0·429	0·288	0·072	0·157	0·203	0·318	0·211	0·470	0·520	0·673	0·719	0·176
6	0·553	0·350	0·240	0·000	0·000	0·067	0·000	0·259	0·000	0·259	0·754	0·000	0·000
7	0·800	0·209	0·100	0·077	0·127	0·000	0·306	0·000	0·155	0·212	0·833	0·506	0·070
8	0·687	0·225	0·373	0·426	0·476	0·269	0·352	0·323	0·602	0·254	0·848	1·320	0·306
9	0·569	0·183	0·000	0·532	0·699	0·471	0·806	0·435	0·306	0·227	0·852	1·218	0·318
10	0·764	0·531	0·132	0·525	0·986	0·636	1·149	0·502	0·512	0·457	0·764	1·183	0·472
11	0·731	0·255	0·062	0·623	1·132	0·892	1·099	0·404	0·356	0·419	0·717	1·153	0·447

TABLE XLVI.—Variations of Magnetic Dip, with reference to the Moon's Hour-Angle, for 1845, as deduced from Tables XXVI. and XXXIX.

Moon's Hour-Angle.	Lunations.			Moon's Hour-Angle.	Lunations.			Moon's Hour-Angle.	Lunations.		
	Summer.	Winter.	Year.		Summer.	Winter.	Year.		Summer.	Winter.	Year.
h.	′	′	′	h.	′	′	′	h.	′	′	′
0	0·146	0·218	0·173	8	0·292	0·234	0·248	16	0·160	0·052	0·089
1	0·081	0·086	0·073	9	0·421	0·203	0·292	17	0·297	0·035	0·145
2	0·066	0·000	0·018	10	0·195	0·157	0·179	18	0·282	0·094	0·168
3	0·000	0·023	0·000	11	0·118	0·128	0·111	19	0·263	0·118	0·173
4	0·119	0·212	0·157	12	0·068	0·113	0·081	20	0·310	0·181	0·229
5	0·115	0·195	0·146	13	0·115	0·157	0·126	21	0·276	0·108	0·174
6	0·159	0·173	0·155	14	0·089	0·073	0·068	22	0·289	0·166	0·212
7	0·228	0·130	0·164	15	0·136	0·118	0·115	23	0·200	0·217	0·197
								24	0·202	0·161	0·167

TABLE XLVII.—Variations of the Total Magnetic Force, with reference to the Moon's Age, Declination, and Distance from the Earth, as deduced from Tables XIX. and XXXII.

Moon's Age.	Variations of Total Force.	Moon's Age.	Variations of Total Force.	After Moon farthest North.	Variations of Total Force.	After Moon farthest North.	Variations of Total Force.	Before and after Perigee.	Variations of Total Force.	Before and after Apogee.	Variations of Total Force.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0038	0	0046	0	0176	14	0182	7	0131	7	0143
16	0055	1	0046	1	0112	15	0148	6	0139	6	0093
17	0030	2	0068	2	0138	16	0174	5	0118	5	0165
18	0045	3	0088	3	0000	17	0225	4	0127	4	0153
19	0085	4	0133	4	0068	18	0148	3	0099	3	0144
20	0080	5	0102	5	0114	19	0177	2	0162	2	0177
21	0020	6	0126	6	0138	20	0137	1	0157	1	0165
22	0060	7	0054	7	0114	21	0196	P	0156	A	0116
23	0094	8	0000	8	0144	22	0173	1	0184	1	0037
24	0051	9	0034	9	0149	23	0096	2	0225	2	0000
25	0006	10	0088	10	0096	24	0144	3	0163	3	0070
26	0042	11	0067	11	0167	25	0164	4	0150	4	0103
27	0005	12	0000	12	0149	26	0122	5	0176	5	0100
28	0035	13	0036	13	0156	27	0149	6	0149	6	0115
29	0028	14	0051					7	0071	7	0134

TABLE XLVIII.—Diurnal Variations of the Total Magnetic Force in 1845, as deduced from Tables XXIII. and XXXVI.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
12	0166	0035	0138	0070	0177	0229	0138	0052	0085	0029	0065	0026	0063
13	0143	0021	0043	0114	0081	0214	0102	0020	0000	0024	0069	0000	0031
14	0000	0000	0000	0000	0073	0220	0073	0012	0010	0018	0035	0015	0000
15	0160	0019	0016	0248	0053	0255	0072	0024	0014	0057	0058	0005	0044
16	0215	0049	0070	0211	0182	0301	0091	0086	0059	0091	0078	0044	0085
17	0251	0057	0160	0323	0233	0309	0089	0121	0105	0093	0095	0069	0121
18	0282	0080	0216	0387	0263	0308	0116	0147	0145	0110	0104	0085	0149
19	0292	0092	0236	0401	0220	0272	0105	0117	0142	0135	0100	0063	0143
20	0275	0092	0224	0349	0127	0209	0073	0056	0114	0102	0065	0064	0108
21	0266	0069	0186	0271	0050	0122	0011	0012	0088	0045	0006	0037	0059
22	0266	0074	0137	0218	0007	0041	0000	0000	0074	0000	0000	0008	0031
23	0323	0085	0135	0192	0000	0000	0011	0010	0134	0018	0024	0004	0040
0	0337	0134	0165	0200	0059	0059	0012	0079	0210	0080	0103	0046	0088
1	0403	0209	0224	0313	0190	0148	0131	0219	0382	0183	0167	0114	0185
2	0450	0289	0356	0449	0293	0238	0230	0318	0507	0260	0229	0196	0280
3	0503	0395	0445	0577	0440	0336	0340	0455	0590	0325	0285	0302	0378
4	0513	0392	0547	0648	0543	0433	0427	0533	0632	0358	0292	0330	0432
5	0528	0421	0652	0706	0618	0494	0486	0557	0680	0338	0309	0367	0475
6	0523	0391	0617	0746	0634	0517	0524	0526	0585	0324	0298	0437	0472
7	0527	0335	0534	0717	0571	0505	0486	0467	0520	0297	0253	0344	0425
8	0517	0299	0436	0615	0498	0457	0446	0374	0416	0266	0216	0139	0352
9	0430	0238	0374	0544	0413	0385	0334	0228	0361	0247	0155	0127	0281
10	0224	0173	0256	0464	0347	0312	0255	0210	0235	0186	0115	0101	0202
11	0145	0120	0225	0383	0294	0241	0222	0087	0176	0068	0075	0065	0137

TABLE XLIX.—Variations of the Total Magnetic Force with reference to the Moon's Hour-Angle for 1845, as deduced from Tables XXVI. and XXXIX.

Moon's Hour-Angle.	Lunations.			Moon's Hour-Angle.	Lunations.			Moon's Hour-Angle.	Lunations.		
	Summer.	Winter.	Year.		Summer.	Winter.	Year.		Summer.	Winter.	Year.
h.	0·00	0·00	0·00	h.	0·00	0·00	0·00	h.	0·00	0·00	0·00
0	0062	0053	0053	8	0032	0016	0018	16	0065	0098	0078
1	0081	0076	0074	9	0000	0008	0000	17	0031	0095	0062
2	0076	0088	0078	10	0046	0012	0037	18	0023	0089	0053
3	0087	0065	0070	11	0060	0064	0058	19	0023	0061	0039
4	0073	0010	0034	12	0061	0084	0069	20	0000	0041	0017
5	0069	0000	0027	13	0080	0079	0074	21	0025	0030	0024
6	0061	0016	0033	14	0081	0095	0084	22	0045	0031	0033
7	0044	0025	0030	15	0077	0090	0079	23	0047	0010	0022
								24	0045	0025	0029

TABLE L.—Ranges for each Civil Day of the Magnetic Declination, and of the Horizontal and Vertical Components of Magnetic Force, as deduced from all the Observations (Hourly, Term-Day, or Extra) made in 1845.

Civil Day.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.
	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0
	JANUARY.			MARCH.			MAY.			JULY.			SEPTEMBER.			NOVEMBER.		
1	16·11	0322	0044	14·63	0251	0074	21·21	0602	0418	14·43	0435	0107	15·44	0476	0097	19·92	0561	0109
2	10·65	0151	0024	...	...	...	9·53	0252	0019	8·70	0472	0040	26·46	0763	0083	...	...	...
3	3·81	0081	0009	14·07	0451	0025	12·17	0358	0022	10·87	0354	0043	22·94	0487	0182	12·56	0225	0071
4	4·55	0073	0016	7·24	0199	0018	...	...	...	14·59	0368	0032	15·20	0889	0085	13·46	0248	0066
5	...	...	...	6·58	0172	0025	9·93	0409	0028	9·87	0323	0042	16·34	0407	0077	34·39	0417	0214
6	2·62	0095	0018	7·40	0193	0013	13·19	0400	0026	...	...	...	13·65	0416	0043	4·87	0200	0046
7	7·73	0225	0029	11·36	0227	0043	14·14	0448	0030	15·06	0269	0081	...	...	...	16·45	0358	0079
8	5·35	0088	0015	9·06	0269	0031	12·36	0412	0035	14·76	0582	0098	20·75	0540	0110	7·18	0161	0032
9	64·96	2622	0570	...	...	...	14·56	0447	0029	14·53	0368	0066	11·06	0468	0064	...	...	...
10	32·09	2321	0133	12·20	0505	0055	11·17	0405	0030	14·69	0421	0061	10·21	0351	0050	18·24	0175	0022
11	9·86	0193	0043	14·30	0235	0026	...	...	...	13·86	0451	0036	16·42	0347	0045	9·87	0210	0059
12	...	...	...	7·48	0172	0022	14·41	0339	0045	9·38	0398	0046	13·36	0399	0094	7·11	0171	0024
13	10·21	0295	0041	12·24	0244	0036	12·71	0427	0043	...	...	...	14·90	0423	0052	4·15	0153	0018
14	10·56	0263	0037	20·99	0480	0072	14·14	0469	0100	12·52	0477	0027	...	...	...	5·06	0154	0018
15	16·28	0449	0033	17·61	0351	0067	17·26	0543	0124	13·60	0361	0024	7·58	0319	0037	4·63	0161	0017
16	5·95	0126	0033	...	...	...	18·44	0799	0082	12·15	0311	0041	13·89	0319	0023	...	...	...
17	11·53	0273	0027	16·96	0587	0092	11·20	0609	0045	15·17	0377	0027	35·27	0682	0107	30·61	0692	0169
18	6·92	0218	0014	16·66	0447	0069	...	...	...	13·99	0364	0025	28·90	1182	0245	21·85	0351	0070
19	...	...	...	18·50	0414	0122	27·30	0885	0253	16·15	0392	0038	20·72	0419	0102	12·30	0217	0043
20	42·00	1715	0479	23·48	0792	0382	15·76	0475	0035	...	...	...	20·39	0545	0040	6·82	0141	0028
21	21·50	0227	0049	17·65	0581	0100	12·91	0441	0066	11·03	0493	0029	...	...	...	6·33	0188	0019
22	20·96	0819	0036	14·80	0322	0084	18·07	0493	0088	13·05	0434	0049	10·71	0308	0028	12·94	0368	0028
23	20·40	0493	0066	...	...	...	12·44	0386	0045	15·48	0462	0028	9·08	0364	0040	...	...	...
24	21·38	0813	0181	31·15	0973	0343	14·38	0573	0038	15·17	0552	0097	22·95	0496	0038	15·14	0381	0027
25	30·14	0785	0121	27·75	0715	0269	...	...	...	35·64	0788	0239	35·05	1002	0461	8·44	0210	0015
26	...	...	...	25·63	0563	0137	8·19	0312	0020	11·00	0344	0030	11·74	0368	0090	7·36	0316	0042
27	18·34	0479	0092	26·67	0934	0176	9·01	0337	0033	...	...	...	34·57	0668	0185	9·91	0139	0021
28	26·70	0664	0135	24·24	0326	0042	9·38	0321	0027	9·06	0389	0050	...	...	...	10·19	0571	0050
29	29·95	0994	0193	20·94	0384	0082	10·87	0314	0036	10·90	0337	0029	11·12	0266	0058	16·11	0392	0064
30	24·67	0532	0065	...	...	...	16·99	0585	0053	11·23	0329	0044	14·60	0256	0062	...	...	...
31	5·58	0231	0043	10·02	0311	0024	34·27	0739	0112	13·55	0419	0046						
	FEBRUARY.			APRIL.			JUNE.			AUGUST.			OCTOBER.			DECEMBER.		
1	9·55	0228	0024	10·34	0336	0021	..	...	...	34·40	1142	0173	13·52	0281	0043	5·18	0148	0022
2	...	...	...	12·99	0290	0034	10·76	0242	0031	19·93	0396	0122	8·50	0328	0061	12·13	0249	0036
3	7·73	0183	0015	17·24	0426	0069	10·76	0351	0041	...	...	...	16·45	0309	0055	125·61	4090	0543
4	11·70	0164	0027	14·23	0417	0024	17·66	0407	0083	16·95	0745	0109	8·39	0336	0079	25·12	1275	0128
5	16·35	0315	0224	13·94	0431	0033	13·22	0438	0052	10·97	0448	0064	...	...	...	10·51	0262	0050
6	21·69	0370	0036	...	...	...	13·37	0384	0031	13·03	0445	0052	11·62	0445	0057	8·80	0221	0026
7	13·11	0200	0035	13·89	0473	0025	16·46	0427	0047	11·42	0340	0050	10·59	0312	0028	...	...	...
8	5·69	0136	0021	13·18	0386	0044	...	...	...	21·60	0508	0108	9·49	0316	0043	6·86	0146	0016
9	...	...	...	13·97	0472	0054	19·31	0526	0068	18·97	0427	0107	32·16	1650	0215	3·79	0123	0012
10	13·33	0217	0035	12·34	0307	0034	15·76	0514	0082	...	...	...	27·83	0693	0197	6·95	0150	0019
11	10·15	0189	0028	14·95	0344	0024	11·16	0385	0061	11·63	0370	0042	9·21	0308	0052	5·28	0130	0018
12	6·05	0241	0023	15·35	0347	0019	14·03	0454	0043	11·44	0353	0020	...	...	...	6·67	0231	0030
13	8·36	0325	0049	...	...	...	12·28	0340	0059	13·03	0374	0040	6·31	0265	0023	33·62	0514	0101
14	5·00	0127	0016	67·37	4200	0697	15·86	0367	0045	9·37	0392	0026	6·58	0207	0026	...	...	...
15	3·26	0105	0012	15·11	0398	0077	...	...	...	19·75	0825	0104	14·61	0209	0030	30·62	0508	0050
16	...	...	...	9·77	0297	0048	12·83	0316	0042	15·49	0521	0044	9·22	0311	0033	18·64	0363	0051
17	10·73	0214	0039	10·10	0351	0036	9·24	0374	0030	...	...	...	20·70	0378	0066	8·61	0230	0047
18	5·54	0118	0010	19·57	0413	0090	11·14	0414	0046	22·60	0575	0132	13·16	0328	0016	15·59	0300	0044
19	5·67	0167	0017	17·59	0729	0133	15·14	0405	0032	13·36	0503	0026	...	...	...	3·50	0101	0016
20	31·51	0413	0055	...	...	...	15·21	0473	0035	12·65	0519	0024	22·61	0430	0068	8·21	0115	0018
21	26·84	0360	0103	13·44	0540	0131	18·42	0444	0023	14·78	0475	0026	52·34	0710	0142	...	...	...
22	20·00	0452	0127	12·63	0416	0047	...	...	...	15·71	0402	0033	15·63	0535	0186	5·49	0143	0006
23	...	...	...	15·47	0424	0030	13·39	0438	0038	19·09	0337	0042	7·02	0251	0026	6·73	0153	0021
24	35·10	0734	0184	16·61	0669	0074	13·88	0431	0039	...	...	...	11·69	0232	0047	7·54	0132	0024
25	24·13	0805	0180	18·38	0619	0107	10·17	0266	0031	16·15	0360	0066	13·26	0335	0085	4·51	0164	0034
26	21·72	0526	0204	14·90	0571	0034	11·92	0428	0040	16·77	0444	0094	...	...	...	5·01	0119	0021
27	32·12	0364	0081	...	...	...	13·86	0349	0038	11·91	0308	0025	8·20	0158	0022	6·39	0230	0033
28	22·00	0269	0102	27·56	1240	0377	18·28	0473	0060	12·41	0374	0034	11·27	0147	0024	...	...	...
29				14·39	0384	0051	...	...	...	53·05	1145	0288	8·23	0146	0037	4·07	0172	0024
30				16·90	0480	0090	11·29	0490	0063	26·16	0974	0280	7·70	0182	0017	16·99	0370	0078
31										...	...	...	14·67	0347	0033	12·76	0148	0044

TABLE LI.—Mean Westerly Declination for each Civil Week-Day and Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′	23° ′
1	8·94	[8·47]	[7·17]	7·40	6·60	7·39	6·37	3·05	5·24	3·09	[4·38]	3·54
2	8·92	9·20	7·62	7·95	5·32	6·42	7·33	[4·36]	4·80	3·65	4·35	4·08
3	8·77	8·58	7·04	7·65	[6·37]	7·04	9·02	4·04	4·95	7·44	5·65	3·24
4	[8·72]	8·55	7·14	6·24	7·63	6·57	7·30	4·35	9·18	[4·42]	3·43	5·14
5	8·62	8·50	7·65	[6·93]	7·00	6·98	[6·95]	4·50	8·07	4·60	4·14	3·55
6	9·05	8·58	7·25	6·52	5·52	5·83	6·68	5·02	[6·72]	3·73	4·38	[3·19]
7	8·01	9·61	7·02	6·36	4·88	[6·10]	6·08	8·51	4·67	4·00	1·58	3·06
8	9·62	[8·86]	[7·15]	6·89	5·07	6·25	5·32	7·32	8·11	5·25	[3·42]	3·07
9	8·96	10·17	6·65	5·71	5·03	4·93	5·57	[6·35]	5·34	5·59	3·64	1·09
10	8·69	7·78	7·55	5·89	[5·34]	6·04	6·46	6·69	5·56	8·47	3·93	2·74
11	[9·14]	8·53	6·81	8·30	6·43	5·61	6·46	6·19	6·67	[5·60]	2·85	4·10
12	10·06	8·96	5·98	[6·52]	4·70	5·57	[6·05]	4·39	6·40	5·62	3·81	3·17
13	8·59	8·42	11·65	8·57	5·93	6·58	6·71	7·64	[6·35]	4·17	3·76	[3·41]
14	8·95	9·67	8·78	4·52	5·20	[5·92]	4·07	6·36	6·76	4·50	3·62	3·58
15	9·77	[7·86]	[8·47]	6·16	6·53	2·98	7·02	5·19	7·51	3·98	[4·19]	3·52
16	9·10	6·64	8·05	6·76	5·41	7·41	4·99	[6·01]	5·22	4·22	3·12	3·38
17	9·39	7·08	8·62	7·70	[5·96]	7·37	6·01	7·60	6·21	3·71	5·01	3·30
18	[9·34]	6·37	7·74	6·27	5·81	5·15	6·29	5·07	5·51	[4·25]	5·82	3·28
19	9·54	8·04	7·45	[6·60]	7·57	7·61	[5·58]	4·23	5·71	4·36	3·48	2·83
20	8·53	7·06	7·36	5·59	5·22	6·40	4·37	4·61	[4·64]	5·22	4·29	[3·11]
21	9·72	7·52	6·64	6·56	6·24	[6·39]	5·84	5·77	2·60	3·99	2·82	2·83
22	9·11	[7·60]	[6·99]	6·69	5·77	8·65	6·01	8·74	1·29	3·80	[3·28]	2·66
23	8·22	6·82	6·80	6·05	7·75	4·95	7·97	[6·03]	6·54	4·64	3·08	3·77
24	10·40	7·20	7·51	6·57	[6·37]	5·58	5·25	5·31	3·24	2·93	2·67	3·21
25	[9·01]	8·96	6·20	7·37	6·07	5·88	3·68	5·82	4·90	[4·03]	3·35	3·14
26	8·88	7·52	7·99	[6·60]	6·81	5·58	[5·98]	5·93	5·56	4·49	1·62	2·80
27	8·11	6·87	6·45	6·44	5·61	4·74	6·39	4·59	[4·02]	4·15	5·34	[2·53]
28	9·33	6·84	7·28	6·19	5·82	[5·70]	5·40	5·58	3·95	4·15	3·17	1·67
29	8·32		[7·21]	6·95	5·91	5·27	7·21	5·02	3·37	4·37	[3·48]	2·08
30	7·79		7·01	6·17	6·76	6·35	5·15	[4·97]	3·08	4·74	3·12	2·26
31	8·36		7·11		[6·56]		5·09	4·60		3·72		1·97

TABLE LII.—Mean Variations of Westerly Declination, after eliminating the Secular Change, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Variations of West Declination.	Moon's Age.	Variations of West Declination.	After Moon farthest North.	Variations of West Declination.	After Moon farthest North.	Variations of West Declination.
Day.	′	Day.	′	Day.	′	Day.	′
15	0·93	0	1·05	0	1·19	14	0·15
16	1·38	1	0·66	1	0·78	15	0·23
17	0·78	2	0·00	2	0·70	16	0·27
18	0·83	3	0·37	3	0·74	17	0·00
19	0·71	4	0·30	4	0·28	18	0·39
20	0·72	5	0·59	5	0·36	19	0·84
21	0·66	6	0·83	6	0·78	20	0·39
22	0·66	7	0·54	7	0·38	21	1·05
23	0·78	8	0·34	8	0·86	22	0·26
24	0·71	9	0·75	9	0·51	23	0·57
25	0·93	10	0·32	10	0·46	24	0·94
26	0·44	11	0·30	11	0·69	25	0·40
27	0·54	12	0·17	12	0·63	26	0·63
28	0·93	13	0·60	13	0·25	27	0·76
29	0·95	14	0·65				

TABLE LIII.—Diurnal Range of Magnetic Declination for each Civil Day, as deduced from the 12 Daily Observations, with the Means for each Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	′	′	′	′	′	′	′	′	′	′	′	′
1	8·95	[9·42]	[11·41]	13·45	9·86	10·20	13·99	12·99	13·50	22·38	[11·16]	13·35
2	3·09	12·06	10·35	12·31	12·03	14·45	25·19	[14·24]	12·23	27·85	18·10	8·08
3	3·47	5·65	9·11	15·86	[14·24]	12·17	10·20	9·67	10·55	8·86	10·43	7·34
4	[6·74]	8·63	15·57	12·91	29·73	11·05	13·89	12·93	24·14	[16·76]	5·34	11·48
5	5·60	4·37	8·09	[18·23]	12·41	12·65	[16·19]	12·84	23·58	7·98	10·37	4·38
6	7·01	4·65	7·21	32·41	8·78	12·79	18·86	21·03	[15·85]	16·42	5·37	[9·44]
7	12·34	9·38	7·62	20·08	14·54	[13·77]	15·44	23·79	7·78	17·09	23·50	3·40
8	8·01	[6·45]	[7·69]	15·80	13·37	17·81	13·54	13·44	17·78	31·31	[11·57]	4·60
9	5·61	8·57	6·82	13·19	16·20	14·60	12·75	[16·11]	11·29	13·63	8·88	25·43
10	3·85	7·47	7·33	11·09	[16·36]	13·75	11·98	12·64	10·95	14·40	6·58	14·20
11	[8·25]	4·26	9·06	14·43	11·86	13·26	22·48	11·98	36·61	[16·93]	14·70	6·12
12	13·10	12·42	15·09	[17·20]	28·51	13·24	[14·65]	13·81	11·85	18·43	6·39	8·36
13	7·43	3·93	22·81	17·91	13·67	21·47	15·57	9·22	[16·50]	15·47	9·44	[6·88]
14	11·50	10·25	21·57	28·64	11·13	[14·89]	13·96	17·21	14·97	8·34	10·70	3·90
15	4·99	[12·91]	[19·86]	17·93	12·57	18·88	11·17	17·96	13·08	6·60	[9·04]	5·18
16	8·69	27·17	20·51	34·78	10·33	9·84	14·26	[14·03]	11·53	8·38	7·05	3·50
17	19·29	10·54	20·40	15·89	[11·65]	12·66	8·21	15·84	13·34	9·48	14·04	4·92
18	[8·47]	13·18	18·80	13·29	11·61	10·62	17·32	13·40	14·72	[9·37]	6·64	9·76
19	7·94	8·10	10·10	[17·04]	12·94	7·31	[11·04]	10·57	19·79	8·73	5·10	3·71
20	3·95	9·99	14·62	12·96	11·34	17·37	9·23	14·13	[25·36]	12·67	14·39	[6·75]
21	5·95	8·19	12·07	11·92	16·46	[12·38]	7·34	14·54	31·82	10·37	7·16	4·66
22	6·66	[7·52]	[12·08]	13·39	17·90	15·08	9·91	16·18	56·45	25·06	[7·11]	5·25
23	4·60	3·61	10·39	13·80	17·32	12·11	13·79	[15·36]	16·05	9·76	4·36	12·21
24	36·83	4·24	12·72	13·13	[15·25]	11·79	15·30	15·87	20·01	17·25	6·87	12·27
25	[12·46]	11·00	12·60	10·22	11·51	11·36	18·26	16·20	10·74	[13·56]	4·80	9·12
26	5·20	9·29	21·45	[11·78]	15·79	13·31	[15·74]	15·24	8·82	10·48	25·96	8·51
27	11·48	14·76	15·21	12·08	12·54	14·59	13·16	17·30	[11·78]	9·78	12·18	[9·13]
28	10·01	9·40	14·14	8·86	13·36	[14·10]	14·16	20·02	13·64	9·02	12·32	10·87
29	10·03		[16·13]	12·60	16·79	13·65	19·79	16·54	8·14	9·02	[13·17]	9·52
30	13·46		17·73	12·63	19·55	17·68	21·09	[15·22]	9·32	12·07	7·14	4·49
31	6·71		14·80		[14·42]		15·92	11·73		12·01		5·62

TABLE LIV.—Means of the Diurnal Ranges of Magnetic Declination, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	′	Day.	′	Day.	′	Day.	′
15	13·22	0	12·83	0	10·58	14	12·31
16	13·75	1	12·90	1	12·43	15	15·51
17	14·16	2	17·93	2	11·22	16	11·43
18	16·66	3	12·22	3	11·82	17	10·21
19	13·34	4	12·95	4	11·26	18	11·73
20	16·31	5	12·44	5	14·33	19	13·44
21	15·74	6	12·58	6	13·08	20	16·01
22	13·05	7	12·49	7	12·45	21	13·36
23	11·55	8	14·42	8	14·73	22	12·10
24	11·42	9	12·37	9	14·34	23	12·86
25	10·14	10	12·71	10	18·68	24	11·64
26	10·43	11	12·92	11	13·01	25	12·30
27	12·52	12	12·59	12	14·37	26	15·86
28	11·71	13	11·75	13	14·20	27	11·66
29	11·94	14	13·25				

TABLE LV.—Means of Westerly Declination at the Observation Hours, for each Month in 1846.

Mean Time.		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Gött.	Mak.													
h.	h.	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′	25° ′
18	17	8·09	6·61	5·36	4·01	2·15	1·70	2·21	2·58	2·97	2·85	2·83	2·28	3·64
20	19	9·16	7·86	5·10	2·80	0·84	1·46	1·02	3·18	4·04	3·96	3·28	3·03	3·81
22	21	9·52	9·12	5·12	4·60	4·43	3·68	3·80	4·05	7·48	4·48	3·14	3·33	5·23
23	22	10·30	9·75	8·04	6·38	7·37	6·61	6·80	7·48	9·64	6·35	4·81	4·15	7·31
0	23	11·48	11·08	11·58	10·92	10·76	9·09	10·41	10·62	11·60	9·00	6·79	5·37	9·89
1	0	11·79	11·50	14·10	13·86	12·71	11·40	12·35	12·79	12·45	10·78	8·57	6·17	11·54
2	1	12·64	11·75	15·66	15·38	13·63	12·87	12·96	13·20	12·16	11·10	8·14	6·43	12·16
4	3	10·82	9·95	11·47	12·25	10·99	11·52	10·83	9·78	8·06	8·70	6·12	4·67	9·60
6	5	9·09	7·77	7·65	7·56	7·56	8·18	8·48	5·96	4·86	3·54	4·81	3·42	6·57
7	6	7·37	6·94	6·45	5·76	6·71	6·95	6·99	4·02	3·48	1·86	3·75	2·31	5·22
8	7	7·68	7·21	5·58	3·92	5·11	6·35	6·13	4·22	0·46	2·19	2·81	2·02	4·47
10	9	6·10	5·70	5·36	4·44	4·22	5·19	4·25	3·28	2·63	2·06	−0·10	0·66	3·65

TABLE LVI.—Diurnal Variations of Westerly Declination for each Month in 1846.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
17	1·99	0·91	0·26	1·21	1·31	0·24	1·19	0·00	2·51	0·99	2·93	1·62	0·00
19	3·06	2·16	0·00	0·00	0·00	0·00	0·00	0·60	3·58	2·10	3·38	2·37	0·17
21	3·42	3·42	0·02	1·80	3·59	2·22	2·78	1·47	7·02	2·62	3·24	2·67	1·59
22	4·20	4·05	2·94	3·58	6·53	5·15	5·78	4·90	9·18	4·49	4·91	3·49	3·67
23	5·38	5·38	6·48	8·12	9·92	7·63	9·39	8·04	11·14	7·14	6·89	4·71	6·25
0	5·69	5·80	9·00	11·06	11·87	9·94	11·33	10·21	11·99	8·92	8·67	5·51	7·90
1	6·54	6·05	10·56	12·58	12·79	11·41	11·94	10·62	11·70	9·24	8·24	5·77	8·52
3	4·72	4·25	6·37	9·45	10·15	10·06	9·81	7·20	7·60	6·84	6·22	4·01	5·96
5	2·99	2·07	2·55	4·76	6·72	6·72	7·46	3·38	4·40	1·68	4·91	2·76	2·93
6	1·27	1·24	1·35	2·96	5·87	5·49	5·97	1·44	3·02	0·00	3·85	1·65	1·58
7	1·58	1·51	0·48	1·12	4·27	4·89	5·11	1·64	0·00	0·33	2·91	1·36	0·83
9	0·00	0·00	0·26	1·64	3·38	3·73	3·23	0·70	2·17	0·20	0·00	0·00	0·01

TABLE LVII.—Mean Values of the Variations of the Horizontal Component of Magnetic Force, the whole Horizontal Component being Unity, for each Civil Week-Day and Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0.00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	6098	[6212]	[6222]	6484	6743	6092	7116	6248	6791	6449	[6800]	7537
2	6248	6116	6103	6924	6944	5671	6854	[6569]	6859	5480	6317	7344
3	6202	6099	6253	6625	[6504]	6007	6629	6576	6637	6594	6771	7447
4	[6234]	6109	6611	6455	5849	6011	6360	6090	5592	[6174]	7056	7348
5	6191	6234	6634	[6183]	6211	6158	[6581]	6541	7655	6397	7021	7836
6	6484	6224	6454	5547	6378	6686	6208	7265	[6341]	6206	7142	[7835]
7	6184	6323	6704	5545	6820	[6325]	6954	5767	5650	5916	6361	8044
8	5893	[6205]	[6670]	6001	7174	6054	6484	6927	6626	6495	[6936]	8147
9	6214	5943	6350	5988	6698	6867	6434	[6461]	5888	5376	6721	8190
10	6514	6090	6954	6726	[6667]	6172	6908	5464	5991	5238	7121	7269
11	[6094]	6414	6925	5928	6764	5903	7148	6265	7015	[5950]	7249	7246
12	6166	6556	6638	[6251]	5950	6926	[6846]	7078	5746	5922	7349	7641
13	5895	6375	6243	6452	6597	7376	7050	6106	[6006]	6108	7581	[7488]
14	5880	7143	5395	6386	6640	[6713]	6491	5801	6142	6563	7150	7209
15	6417	[6438]	[5979]	6029	6149	7214	7048	6264	5085	7038	[7459]	7534
16	6290	6184	6168	6811	6274	6137	6435	[6177]	6058	6603	7454	8027
17	5957	6296	5591	5839	[6877]	6720	6711	6089	6388	7033	9194	7936
18	[6304]	6076	5841	5673	7504	6365	7305	6419	6469	[6891]	6026	7870
19	6354	6252	5975	[6295]	7789	6287	[7001]	6384	6786	6929	6768	8128
20	6266	6554	6176	6267	6904	5818	7028	6423	[6095]	6763	7572	[8043]
21	6543	6580	6139	6075	6953	[6620]	7141	6355	6965	6981	7018	8347
22	6389	[6505]	[6335]	7128	5666	7076	7384	6538	4294	5845	[7287]	8299
23	6469	6755	6455	6453	6821	7014	7097	[6390]	5667	6521	7330	7678
24	5956	6700	6512	6708	[6632]	7160	7799	6522	6236	6941	7534	7550
25	[6158]	6191	6752	6511	7012	7034	7642	6361	6274	[6702]	7499	7547
26	5992	5990	6847	[6571]	6666	6867	[7285]	6144	5996	6972	8279	7369
27	6137	6103	6584	6468	6674	7156	7070	5904	[6294]	6725	6698	[7772]
28	6004	6271	6177	6298	6797	[7038]	6439	6954	6211	7208	6631	7973
29	6322		[6468]	6987	6931	7060	7664	7348	6508	6953	[7280]	8260
30	6452		6300	6900	7707	6997	6604	[6686]	6540	6593	7190	7936
31	6172		6414		[6534]		7356	6263		7111		8209

TABLE LVIII.—Mean Variations of the Horizontal Component of Magnetic Force, after eliminating the Secular Change, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Variations of Horizontal Component.	Moon's Age.	Variations of Horizontal Component.	After Moon farthest North.	Variations of Horizontal Component.	After Moon farthest North.	Variations of Horizontal Component.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0352	0	0329	0	0204	14	0259
16	0281	1	0478	1	0249	15	0187
17	0067	2	0229	2	0344	16	0152
18	0311	3	0388	3	0217	17	0302
19	0260	4	0495	4	0386	18	0427
20	0137	5	0415	5	0347	19	0368
21	0311	6	0424	6	0349	20	0447
22	0000	7	0414	7	0293	21	0232
23	0279	8	0484	8	0210	22	0100
24	0455	9	0166	9	0412	23	0154
25	0232	10	0113	10	0003	24	0090
26	0368	11	0317	11	0335	25	0085
27	0348	12	0189	12	0000	26	0410
28	0736	13	0397	13	0150	27	0230
29	0552	14	0351				

TABLE LIX.—Diurnal Range of the Horizontal Component of Magnetic Force for each Civil Day, as deduced from the 12 Daily Observations, with the Means for each Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	0124	[0196]	[0248]	0417	0408	0513	0648	0836	0381	0405	[0290]	0356
2	0097	0234	0289	0382	0505	0713	0728	[0649]	0346	0400	0263	0552
3	0121	0174	0239	0273	[0621]	0617	0549	0648	0351	0452	0339	0148
4	[0145]	0151	0347	0344	1200	0572	0703	0560	0344	[0365]	0229	0247
5	0132	0128	0215	[0695]	0666	0454	[0670]	0383	1636	0223	0239	0161
6	0138	0161	0200	2083	0539	0535	0968	0666	[0688]	0232	0250	[0165]
7	0258	0157	0147	0606	0562	[0613]	0552	1160	0324	0481	0522	0121
8	1281	[0165]	[0177]	0483	0337	0374	0521	1073	0902	1474	[0297]	0146
9	0123	0269	0208	0424	0481	0998	0609	[0808]	0572	0477	0235	0167
10	0171	0202	0084	0576	[0848]	0748	0676	0652	0402	0591	0328	0180
11	[0215]	0073	0207	0617	0536	0564	0968	0587	0861	[0611	0207	0186
12	0279	0288	0250	[0512]	2045	0514	[0748]	0709	0698	0448]	0254	0171
13	0130	0142	0529	0601	1125	0522	0949	0832	[0597]	0397	0239	[0220]
14	0308	0401	0455	0421	0740	[0681]	0756	0541	0582	0279	0279	0383
15	0090	[0277]	[0444]	0433	0652	1026	0528	0775	0663	0227	[0525]	0182
16	0153	0439	0223	1161	0567	0764	0628	[0680]	0378	0328	0169	0217
17	0228	0177	0435	0634	[0664]	0694	0693	0945	0431	0300	1775	0162
18	[0179]	0217	0770	0435	0506	0450	0579	0460	0347	[0301]	0433	0177
19	0252	0155	0377	[0627]	0668	0362	[0619]	0528	0309	0278	0283	0130
20	0121	0170	0389	0448	0852	0390	0624	0428	[0725]	0246	0271	[0163]
21	0228	0117	0266	0363	0732	[0430]	0472	0553	0448	0427	0201	0072
22	0186	[0183]	[0367]	0720	0668	0425	0718	0501	2407	0470	[0221]	0105
23	0265	0069	0382	0429	0818	0460	0499	[0559]	0408	0417	0204	0335
24	0636	0096	0398	0601	[0609]	0495	0841	0601	0587	0348	0190	0143
25	[0252]	0491	0390	0495	0593	0702	0641	0640	0524	[0348]	0175	0304
26	0105	0232	0563	[0482]	0425	0493	[0674]	0630	0466	0255	0834	0121
27	0159	0201	0437	0470	0417	0526	0520	0765	[0462]	0310	0256	[0211]
28	0163	0178	0498	0479	0377	[0627]	0470	0664	0647	0286	0535	0212
29	0256		[0461]	0420	0436	0733	1073	0984	0294	0282	[0469]	0263
30	0162		0466	0410	0594	0659	0680	[0593]	0256	0328	0282	0224
31	0202		0387		[0542]		0787	0428		0297		0065

TABLE LX.—Means of the Diurnal Ranges of the Horizontal Component of Magnetic Force, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	5892	0	4419	0	3982	14	5249
16	4915	1	4277	1	4301	15	5015
17	5922	2	5674	2	3651	16	3915
18	6215	3	3801	3	3999	17	3576
19	4459	4	3951	4	4091	18	4185
20	5362	5	4292	5	5401	19	4645
21	5567	6	4463	6	4052	20	6172
22	4509	7	4212	7	3938	21	5153
23	4495	8	5359	8	4602	22	4487
24	3967	9	4884	9	4753	23	4520
25	4333	10	5617	10	5975	24	4427
26	4475	11	4222	11	5777	25	4057
27	3927	12	4186	12	5004	26	5478
28	5307	13	3457	13	5919	27	4344
29	4607	14	3911				

TABLE LXI.—Means of the Scale Readings of the Bifilar Magnetometer, corrected for Temperature, at the Observation Hours, for each Month in 1846.

Mean Time.		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Gött.	Mak.													
h.	h.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.	Sc. Div.
18	17	549·57	547·45	549·02	548·68	543·22	540·90	543·74	542·03	543·94	552·11	555·58	559·39	547·97
20	19	547·59	547·46	546·76	546·10	540·26	535·67	538·65	536·96	536·75	546·21	553·46	558·43	544·52
22	21	544·23	543·83	538·30	533·86	532·03	530·90	532·08	526·15	528·20	537·56	545·74	555·66	537·38
23	22	542·24	543·07	536·20	531·72	529·75	532·04	532·12	528·86	531·94	536·28	543·22	552·56	536·67
0	23	541·96	543·71	535·86	531·36	534·27	537·17	536·36	534·26	534·15	537·48	544·82	553·94	538·78
1	0	542·37	545·36	539·07	535·38	539·37	542·23	542·78	539·35	542·78	540·06	547·45	554·58	542·56
2	1	546·14	546·70	545·98	543·19	549·74	548·67	547·38	547·17	550·50	546·84	550·60	557·17	548·34
4	3	546·96	549·18	553·02	553·04	559·91	557·77	564·58	556·14	559·57	554·02	554·28	558·95	555·62
6	5	548·77	549·64	553·14	559·72	570·52	564·93	573·19	567·43	560·99	552·21	559·36	560·30	560·02
7	6	547·17	548·87	552·88	561·72	565·29	566·62	570·56	566·62	553·76	553·74	560·94	560·70	559·07
8	7	548·96	550·15	552·59	556·87	566·47	564·47	566·62	562·58	552·96	551·77	558·50	560·53	557·71
10	9	547·27	547·06	552·71	550·87	551·26	555·41	557·42	552·17	542·90	551·08	553·95	556·96	551·59

TABLE LXII.—Diurnal Variations of the Horizontal Component of Magnetic Force for each Month in 1846.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
17	1027	0591	1777	2338	1818	1350	1574	2144	2125	2137	1669	0922	1526
19	0760	0593	1471	1990	1419	0644	0887	1459	1154	1341	1382	0792	1061
21	0306	0103	0329	0337	0308	0000	0000	0000	0000	0173	0340	0418	0096
22	0038	0000	0046	0049	0000	0154	0005	0366	0505	0000	0000	0000	0000
23	0000	0086	0000	0000	0610	0846	0578	1095	0803	0162	0216	0186	0285
0	0055	0309	0433	0543	1299	1530	1444	1782	1968	0510	0571	0273	0796
1	0564	0490	1366	1597	2699	2399	2065	2838	3010	1426	0996	0622	1576
3	0675	0825	2317	2927	4072	3627	4387	4049	4235	2395	1493	0863	2558
5	0919	0887	2333	3829	5504	4594	5550	5573	4427	2151	2179	1045	3152
6	0703	0783	2298	4099	4798	4822	5195	5463	3451	2357	2392	1099	3025
7	0945	0956	2259	3444	4957	4532	4663	4918	3343	2091	2063	1076	2840
9	0717	0539	2275	2634	2904	3309	3421	3513	1984	1998	1449	0594	2014

TABLE LXIII.—Mean Values of the Variations of the Vertical Component of Magnetic Force, the whole Vertical Component being unity, for each Civil Week-Day and Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	4066	[3793]	[3657]	3451	3448	3637	.....	3677	3534	3310	[2861]	2710
2	4128	3915	3655	3364	3433	3477	.....	[3710]	3453	3360	2895	2716
3	4145	3814	3683	3373	[3494]	3825	3927	3659	3422	2980	2825	2691
4	[4060]	3882	3579	3713	3594	4120	3497	3796	3489	[3261]	2723	2810
5	4084	3872	3624	[3545]	3396	3952	[3778]	3731	4122	3349	2867	2723
6	4038	3942	3705	3603	3592	3978	3956	3764	[3799]	3331	2806	[2706]
7	3901	3906	3686	3593	3749	[4054]	3827	3702	3638	3237	2878	2690
8	3813	[3932]	[3672]	3625	3611	4079	3681	3740	4086	3394	[2912]	2651
9	3843	4073	3774	3605	3778	4062	3850	[3818]	4038	3502	2963	2672
10	3963	3952	3671	3696	[3611]	4131	3677	3880	3988	3431	2966	2717
11	[3958]	3849	3572	3312	3634	4112	4285	3775	4165	[3437]	2991	2654
12	4043	3731	3559	[3498]	3314	4040	[3921]	4046	3648	3464	2741	2579
13	4117	3695	3928	3487	3582	3959	4124	4084	[3758]	3482	2696	[2646]
14	3971	3613	3788	3413	3598	[4059]	3781	3442	3625	3351	2705	2589
15	3947	[3694]	[3740]	3474	3471	4119	3807	3949	3543	3165	[2879]	2670
16	3961	3912	3602	3699	3615	4090	3752	[3724]	3582	3069	2766	2666
17	4069	3563	3793	3322	[3565]	4032	3944	3463	3516	3010	3457	2651
18	[3973]	3651	3768	3496	3532	4146	4102	3640	3580	[3148]	2911	2617
19	4021	3668	3792	[3517]	3522	3885	[3839]	3767	3817	3244	3071	2629
20	3927	3647	3744	3457	3650	3900	3745	3655	[3424]	3172	3041	[2651]
21	3915	3671	3741	3516	3731	[3957]	3729	3646	3631	3227	2966	2643
22	3925	[3549]	[3674]	3613	3868	3899	3763	3381	3003	3420	[2901]	2555
23	3854	3415	3652	3528	3742	4008	3936	[3584]	2996	3073	2782	2809
24	3725	3378	3621	3537	[3717]	3903	3915	3651	3288	3079	2737	2662
25	[3775]	3515	3495	3383	3763	3890	3680	3612	3397	[3124]	2807	2688
26	3726	3831	3544	[3559]	3557	3691	[3855]	3560	3526	3134	3233	2711
27	3675	3567	3597	3689	3640	3784	3751	3468	[3383]	3120	3072	[2580]
28	3748	3626	3554	3627	3700	[3796]	3588	3537	3408	2919	2813	2633
29	3678		[3541]	3588	3596	3812	4258	3497	3353	2906	[2885]	2392
30	3749		3588	3504	3569	3801	3754	[3501]	3328	2979	2767	2396
31	3721		3515		[3634]		3614	3515		2841		2448

TABLE LXIV.—Mean Variations of the Vertical Component of Magnetic Force, after eliminating the Secular Change, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Variations of Vertical Component.	Moon's Age.	Variations of Vertical Component.	After Moon farthest North.	Variations of Vertical Component.	After Moon farthest North.	Variations of Vertical Component.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0080	0	0028	0	0066	14	0111
16	0116	1	0069	1	0086	15	0113
17	0088	2	0006	2	0087	16	0055
18	0119	3	0016	3	0144	17	0055
19	0134	4	0004	4	0109	18	0000
20	0182	5	0006	5	0071	19	0069
21	0155	6	0059	6	0014	20	0179
22	0087	7	0000	7	0043	21	0119
23	0117	8	0044	8	0082	22	0083
24	0084	9	0064	9	0169	23	0185
25	0019	10	0040	10	0060	24	0125
26	0034	11	0035	11	0073	25	0086
27	0018	12	0084	12	0081	26	0169
28	0066	13	0036	13	0071	27	0113
29	0087	14	0060				

TABLE LXV.—Diurnal Range of the Vertical Component of Magnetic Force for each Civil Day, as deduced from the 12 Daily Observations, with the Means for each Week in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
1	0092	[0286]	[0319]	0422	0219	0597	.....	1006	0611	0826	[0442	0270
2	0136	0395	0211	0248	0756	2200	.....	[0697]	0145	1436	0990	0237
3	0109	0222	0285	0459	[1086]	0799	1649	0703	0400	1529	0405	0114
4	[0157]	0225	0226	0572	2131	0391	2368	0447	1422	[1109]	0198	0886
5	0157	0133	0281	[1240]	1931	0522	[1505]	0301	6065	0464	0387	0152
6	0112	0169	0212	4404	1157	0714	1463	0899	[1876]	0501	0144	[0296]
7	0339	0596	0220	0769	0786	[0805]	0871	2213	0195	1900	0833	0093
8	0265	[0327]	[0208]	0988	0824	0172	1172	2063	2099	8852	[0308]	0045
9	0295	0708	0276	0216	1127	1949	0324	[1514]	1074	1014	0128	0484
10	0115	0267	0148	0896	[1094]	1083	0522	1711	0907	4828	0215	0598
11	[0327]	0092	0110	1284	0308	0278	2094	0629	5138	[2756]	0144	0507
12	0479	0253	0206	[0889]	2669	0328	[1080]	1571	1899	0893	0157	0249
13	0138	0162	2472	2039	0848	0548	1942	1817	[1812]	0692	0230	[0315]
14	0668	0180	1768	0381	0957	[0628]	0448	3345	1755	0260	0382	0233
15	0152	[0330]	[1259]	0517	0649	1343	1149	1919	0927	0274	[1238]	0189
16	0155	0763	1469	2473	0330	0885	0551	[1743]	0247	0688	0172	0117
17	0612	0258	1067	0941	[0743]	0387	0620	1842	0833	0167	5699	0113
18	[0216]	0363	0572	0285	0437	0519	1134	0704	0179	[0489]	0787	0231
19	0186	0157	0306	[0891]	1292	0512	[0701]	0930	1121	0828	0226	0179
20	0062	0088	0254	0661	0796	0370	0307	0386	[2041]	0682	0426	[0379]
21	0128	0191	0376	0214	0758	[0499]	0542	0574	1555	0293	0245	0155
22	0090	[0243]	[0264]	0770	0366	0464	1051	1842	6862	1133	[0258]	0142
23	0116	0087	0253	0191	0619	0597	0817	[0805]	1698	0347	0201	1455
24	0707	0133	0217	0332	[0612]	0530	1148	0760	0475	0336	0170	0779
25	[0283]	0801	0178	0865	1027	0232	1105	0890	0401	[0412]	0280	0405
26	0152	0525	0482	[0369	0481	0253	[1244]	0379	0484	0108	7017	0475
27	0121	0255	0400	0452	0422	0586	0801	1136	[0408]	0365	0798	[0383]
28	0514	0412	0437	0165	0638	[0502]	0586	1831	0431	0183	0663	0275
29	0502		[0392]	0211	0302	0652	3007	1122	0429	0260	[1644]	0174
30	0186		0442	0320	0955	0786	0412	[0855]	0230	0504	0879	0190
31	0185		0169		[0915]		1316	0287		0296		0225

TABLE LXVI.—Means of the Diurnal Ranges of the Vertical Component of Magnetic Force, with reference to the Moon's Age and Declination for 1846.

Moon's Age.	Mean Range.	Moon's Age.	Mean Range.	After Moon farthest North.	Mean Range.	After Moon farthest North.	Mean Range.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	1207	0	0740	0	0874	14	0631
16	0948	1	0650	1	0860	15	0659
17	1132	2	1082	2	0583	16	0448
18	1502	3	0573	3	0542	17	0322
19	0753	4	0382	4	0505	18	0505
20	1177	5	0523	5	0917	19	0796
21	1268	6	0711	6	0685	20	1779
22	0850	7	0610	7	0711	21	0947
23	0658	8	1356	8	0817	22	0479
24	0703	9	0825	9	1043	23	0819
25	0542	10	1012	10	1179	24	0662
26	0494	11	0751	11	1270	25	0755
27	0408	12	0674	12	0961	26	1572
28	0827	13	0607	13	0650	27	0752
29	0802	14	0673				

TABLE LXVII.—Means of the Micrometer Readings of the Balance Magnetometer corrected for Temperature, at the Observation Hours, for each Month in 1846.

Mean Time.		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Gött.	Mak.													
h.	h.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.	Mic. Div.
18	17	385·2	369·6	361·5	333·1	336·9	373·8	351·3	335·9	334·5	273·8	276·9	257·3	332·5
20	19	386·4	371·1	365·2	344·8	353·5	391·2	372·1	356·6	346·9	307·1	280·5	258·3	344·5
22	21	388·1	373·0	369·0	354·3	355·3	392·0	378·3	372·0	353·2	325·4	289·4	260·4	350·9
23	22	389·2	372·7	366·7	355·0	353·2	389·5	374·1	370·5	361·7	326·5	288·7	262·7	350·9
0	23	392·2	374·5	364·4	356·0	351·2	384·0	367·4	364·3	365·7	325·8	287·3	264·2	349·7
1	0	394·3	376·0	366·0	352·7	351·9	386·0	368·0	365·1	373·8	331·4	288·9	264·8	351·6
2	1	397·3	375·8	371·8	356·7	356·7	388·0	373·0	371·0	377·8	338·2	293·5	266·3	355·5
4	3	403·3	386·4	392·1	374·3	384·4	398·6	402·5	396·7	407·5	360·1	306·3	273·6	373·8
6	5	401·5	384·8	397·5	388·1	397·2	409·9	428·9	414·5	406·7	352·5	306·5	274·7	380·2
7	6	400·9	383·3	388·9	391·9	397·5	412·4	426·5	416·6	387·6	349·7	337·0	272·8	380·4
8	7	399·3	380·0	383·0	387·8	394·9	414·1	417·8	408·5	380·9	336·8	322·9	275·0	375·1
10	9	396·5	375·9	362·8	345·4	364·1	404·1	387·1	349·5	333·5	321·0	286·7	270·9	349·8

TABLE LXVIII.—Diurnal Variations of the Vertical Component of Magnetic Force, for each Month in 1846.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
17	0000	0000	0000	0000	0000	0000	0000	0000	0010	0000	0000	0000	0000
19	0012	0015	0037	0117	0166	0174	0208	0207	0134	0333	0036	0010	0120
21	0029	0034	0075	0212	0184	0182	0270	0361	0197	0516	0125	0031	0184
22	0040	0031	0052	0219	0163	0157	0228	0346	0282	0527	0118	0054	0184
23	0070	0049	0029	0229	0143	0102	0161	0284	0312	0520	0104	0069	0172
0	0091	0064	0045	0196	0150	0122	0167	0292	0403	0576	0120	0075	0191
1	0121	0062	0103	0236	0198	0142	0217	0351	0443	0644	0166	0090	0230
3	0181	0168	0306	0412	0475	0248	0512	0608	0740	0863	0294	0163	0413
5	0163	0152	0360	0550	0603	0361	0776	0786	0732	0787	0296	0174	0477
6	0157	0137	0274	0588	0606	0386	0752	0807	0541	0759	0601	0155	0479
7	0141	0104	0215	0547	0580	0403	0665	0726	0474	0630	0460	0177	0426
9	0113	0063	0013	0123	0272	0303	0358	0136	0000	0472	0098	0136	0173

TABLE LXIX.—Variations of Magnetic Dip with reference to the Moon's Age and Declination for 1846, as deduced from Tables LVIII. and LXIV.

Moon's Age.	Variations of Magnetic Dip.	Moon's Age.	Variations of Magnetic Dip.	After Moon farthest North.	Variations of Magnetic Dip.	After Moon farthest North.	Variations of Magnetic Dip.
Day.	′	Day.	′	Day.	′	Day.	′
15	0·414	0	0·385	0	0·300	14	0·290
16	·525	1	·272	1	·274	15	·367
17	·719	2	·467	2	·177	16	·343
18	·497	3	·310	3	·368	17	·187
19	·566	4	·186	4	·156	18	·000
20	·744	5	·272	5	·157	19	·133
21	·535	6	·317	6	·096	20	·165
22	·787	7	·266	7	·184	21	·326
23	·529	8	·239	8	·311	22	·426
24	·311	9	·591	9	·191	23	·476
25	·475	10	·621	10	·503	24	·480
26	·350	11	·404	11	·172	25	·445
27	·354	12	·588	12	·528	26	·193
28	·000	13	·322	13	·362	27	·322
29	·213	14	·394				

TABLE LXX.—Diurnal Variations of Magnetic Dip for each Month in 1846, as deduced from Tables LXII. and LXVIII.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	′	′	′	′	′	′	′	′	′	′	′	′	′
17	0·000	0·271	0·504	1·219	3·206	3·210	3·328	2·749	1·643	0·000	0·222	0·023	1·195
19	0·290	0·285	0·861	1·703	3·794	4·125	4·259	3·677	2·782	1·174	0·558	0·169	1·803
21	0·780	0·814	2·088	3·521	4·968	4·803	5·246	5·354	4·048	2·579	1·734	0·580	2·873
22	1·070	0·918	2·358	3·828	5·267	4·617	5·197	4·958	3·611	2·770	2·081	1·038	2·973
23	1·141	0·848	2·382	3·889	4·611	3·840	4·531	4·136	3·332	2·594	1·842	0·860	2·664
0	1·105	0·631	1·948	3·290	3·902	3·150	3·637	3·429	2·215	2·291	1·489	0·776	2·152
1	0·607	0·441	1·038	2·236	2·496	2·267	3·043	2·392	1·173	1·409	1·095	0·429	1·382
3	0·554	0·203	0·261	1·035	1·356	1·100	0·935	1·400	0·208	0·629	0·711	0·254	0·551
5	0·282	0·122	0·300	0·241	0·000	0·212	0·000	0·000	0·000	0·804	0·000	0·076	0·000
6	0·500	0·213	0·247	0·000	0·737	0·000	0·344	0·137	0·817	0·560	0·095	0·000	0·134
7	0·232	0·000	0·226	0·638	0·545	0·320	0·807	0·619	0·859	0·703	0·291	0·047	0·271
9	0·440	0·391	0·000	1·040	2·360	1·488	1·780	1·467	1·780	0·635	0·553	0·506	0·867

TABLE LXXI.—Variations of the Total Magnetic Force, with reference to the Moon's Age and Declination for 1846, as deduced from Tables LVIII. and LXIV.

Moon's Age.	Variations of Total Force.	Moon's Age.	Variations of Total Force.	After Moon farthest North.	Variations of Total Force.	After Moon farthest North.	Variations of Total Force.
Day.	0·00	Day.	0·00	Day.	0·00	Day.	0·00
15	0079	0	0030	0	0036	14	0082
16	0104	1	0082	1	0059	15	0077
17	0057	2	0000	2	0069	16	0021
18	0110	3	0025	3	0108	17	0036
19	0118	4	0026	4	0094	18	0000
20	0148	5	0019	5	0055	19	0056
21	0142	6	0068	6	0005	20	0163
22	0049	7	0014	7	0025	21	0087
23	0105	8	0060	8	0051	22	0041
24	0093	9	0046	9	0150	23	0138
25	0012	10	0019	10	0010	24	0077
26	0039	11	0035	11	0056	25	0042
27	0023	12	0066	12	0029	26	0150
28	0106	13	0044	13	0035	27	0081
29	0106	14	0061				

TABLE LXXII.—Diurnal Variations of Total Magnetic Force for each Month in 1846, as deduced from Tables LXII. and LXVIII.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·00
17	0066	0033	0157	0039	0041	0000	0000	0000	0051	0000	0066	0047	0000
19	0049	0046	0159	0108	0149	0083	0116	0115	0062	0217	0069	0042	0060
21	0017	0013	0075	0023	0051	0024	0080	0103	0000	0261	0039	0023	0017
22	0000	0000	0025	0000	0000	0018	0043	0123	0128	0253	0000	0000	0008
23	0023	0025	0000	0003	0045	0040	0042	0146	0186	0263	0009	0033	0026
0	0048	0061	0059	0030	0122	0128	0136	0224	0387	0349	0060	0047	0096
1	0127	0079	0208	0174	0310	0235	0245	0386	0530	0504	0145	0097	0212
3	0192	0208	0487	0469	0699	0457	0749	0741	0923	0801	0311	0187	0477
5	0201	0200	0537	0686	0962	0658	1106	1058	0936	0707	0384	0216	0596
6	0173	0176	0456	0748	0892	0704	1048	1065	0664	0704	0679	0204	0584
7	0184	0164	0400	0643	0885	0689	0915	0937	0592	0560	0519	0222	0517
9	0135	0084	0220	0180	0397	0474	0511	0263	0027	0409	0131	0135	0206

TABLE LXXIII.—Ranges for each Civil Day of the Magnetic Declination, and of the Horizontal and Vertical Components of Magnetic Force, as obtained from all the Observations (Daily or Extra) made in 1846.

Civil Day.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.	Declination.	Hor. Comp.	Vert. Comp.
	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0	′	0·0	0·0
	JANUARY.			MARCH.			MAY.			JULY.			SEPTEMBER.			NOVEMBER.		
1	8·95	0124	0009	...	...	...	9·86	0408	0022	13·99	0648	...	13·50	0381	0061	...	...	...
2	3·50	0115	0019	10·35	0289	0021	12·03	0505	0076	25·19	0728	...	12·23	0346	0014	18·10	0263	0099
3	7·91	0131	0018	9·11	0239	0028	...	...	...	10·20	0549	0165	10·55	0351	0040	10·43	0339	0040
4	...	...	...	15·57	0347	0023	38·92	1833	0424	16·13	0703	0237	29·50	0930	0165	5·34	0229	0020
5	10·50	0139	0026	8·09	0215	0028	12·41	0666	0193	...	...	...	43·02	1767	0622	10·37	0239	0039
6	7·85	0167	0025	7·21	0200	0021	8·78	0539	0116	25·02	1045	0146	...	...	...	5·37	0250	0014
7	17·40	0269	0057	7·62	0147	0022	14·54	0562	0079	15·44	0552	0087	7·78	0324	0019	24·07	0598	0101
8	11·55	0281	0036	...	...	...	13·37	0337	0082	14·42	0521	0117	24·76	1015	0210	...	...	...
9	5·97	0132	0029	6·82	0208	0028	16·20	0481	0113	12·75	0609	0032	11·29	0572	0107	8·88	0235	0013
10	5·69	0171	0012	7·33	0084	0015	..	...	...	11·98	0676	0052	12·72	0402	0091	6·58	0328	0021
11	...	...	...	9·06	0207	0011	11·86	0536	0031	32·70	1296	0291	58·41	1095	0575	14·70	0207	0014
12	13·10	0279	0048	15·09	0250	0021	50·22	3485	0644	...	...	...	11·85	0698	0190	6·39	0254	0016
13	7·43	0130	0014	39·22	1565	0342	15·44	1125	0085	19·07	1014	0222	...	...	...	9·44	0239	0023
14	11·50	0308	0067	33·24	0849	0240	11·13	0740	0096	14·91	0756	0045	14·97	0707	0175	10·70	0279	0038
15	4·99	0090	0015	...	...	...	12·57	0652	0065	11·17	0528	0115	13·08	0663	0093	...	...	...
16	8·69	0153	0015	36·81	1301	0333	10·33	0567	0033	14·26	0628	0055	11·53	0378	0025	7·05	0169	0017
17	19·29	0228	0061	32·88	0880	0344	...	...	...	8·21	0693	0062	13·34	0431	0083	43·54	1775	0648
18	...	...	...	18·80	0770	0057	11·61	0506	0044	17·32	0579	0113	14·72	0347	0018	6·64	0433	0079
19	7·94	0252	0019	10·10	0377	0031	12·94	0668	0135	...	...	...	32·81	0364	0112	5·10	0283	0023
20	3·95	0121	0006	14·62	0389	0025	11·34	0852	0080	9·23	0624	0031	...	...	...	14·39	0271	0043
21	5·95	0228	0013	12·07	0266	0038	16·46	0732	0076	7·34	0472	0054	40·10	0728	0176	7·16	0201	0024
22	6·66	0186	0009	...	...	...	17·90	0668	0037	9·91	0718	0105	121·52	4995	1178	...	...	...
23	4·60	0265	0012	10·39	0382	0025	17·32	1238	0127	13·79	0499	0082	16·05	0408	0170	4·36	0204	0020
24	51·65	0672	0100	12·72	0398	0022	...	...	...	15·30	0841	0115	20·01	0587	0047	6·87	0190	0017
25	...	...	...	12·60	0390	0018	11·51	0593	0103	18·26	0641	0113	10·74	0524	0040	4·80	0175	0028
26	5·20	0105	0015	21·45	0563	0048	15·79	0425	0048	...	...	...	8·82	0466	0048	44·90	1037	0705
27	11·48	0159	0012	20·42	0437	0040	12·54	0417	0042	13·16	0520	0080	...	...	...	15·38	0362	0080
28	10·01	0163	0051	14·14	0498	0044	13·36	0377	0064	14·16	0470	0059	19·48	0647	0043	12·32	0535	0066
29	10·03	0256	0050	...	...	...	16·79	0436	0030	22·67	1211	0347	8·14	0294	0043	...	...	...
30	13·46	0162	0019	17·73	0466	0054	19·55	0594	0095	21·09	0680	0041	15·08	0271	0023	7·14	0282	0088
31	6·71	0202	0018	14·80	0387	0017	...	...	...	15·92	0787	0132						
	FEBRUARY.			APRIL.			JUNE.			AUGUST.			OCTOBER.			DECEMBER.		
1	...	...	...	13·45	0417	0042	10·20	0513	0060	24·25	0836	0101	22·38	0405	0083	13·35	0356	0027
2	12·06	0234	0039	12·31	0382	0025	37·82	1304	0238	...	...	...	29·96	0400	0161	8·08	0552	0024
3	5·65	0174	0022	15·86	0273	0046	12·17	0617	0080	9·67	0648	0070	8·86	0452	0153	7·34	0148	0011
4	8·63	0151	0022	12·91	0344	0057	11·05	0572	0039	12·93	0560	0045	...	...	...	11·48	0247	0089
5	4·37	0128	0013	...	...	...	12·65	0454	0052	12·84	0383	0030	7·98	0223	0046	4·38	0161	0015
6	4·65	0161	0017	36·67	2355	0457	12·79	0535	0071	21·03	0666	0090	16·42	0232	0050	...	...	...
7	9·38	0157	0060	20·08	0625	0210	...	...	...	54·89	2078	0221	44·57	0965	0237	3·40	0121	0009
8	...	...	...	15·80	0483	0099	17·81	0374	0017	15·14	1231	0220	41·42	3197	1062	4·60	0146	0004
9	8·57	0269	0071	13·19	0424	0022	14·60	0998	0207	...	...	...	13·63	0494	0101	25·43	0223	0048
10	7·47	0202	0027	11·09	0576	0090	13·75	0748	0108	12·64	0652	0171	16·38	0591	0483	14·20	0180	0060
11	4·26	0073	0009	14·43	0617	0128	13·26	0564	0028	11·98	0587	0063	...	...	...	6·12	0186	0051
12	12·42	0288	0025	...	...	...	13·24	0514	0033	28·17	1021	0271	18·43	0448	0089	8·36	0171	0025
13	3·93	0142	0016	17·91	0601	0211	21·47	0522	0055	10·45	0832	0199	15·47	0397	0069	...	...	...
14	10·25	0401	0018	28·64	0585	0076	...	...	...	24·69	0998	0340	8·34	0279	0026	3·90	0383	0023
15	...	...	...	21·13	0621	0052	18·88	1026	0134	17·96	0775	0192	6·60	0227	0027	5·18	0182	0019
16	35·69	0444	0089	39·39	2157	0426	9·84	0764	0088	...	...	...	8·38	0328	0069	3·50	0217	0012
17	10·54	0177	0026	27·70	1266	0314	12·66	0694	0039	23·14	1075	0187	9·48	0300	0017	4·92	0162	0011
18	13·18	0217	0036	13·29	0435	0028	10·62	0450	0052	13·40	0460	0070	...	...	...	9·76	0177	0023
19	8·10	0155	0016	...	...	...	14·93	0362	0059	10·57	0528	0093	8·73	0278	0083	3·71	0130	0018
20	9·99	0170	0014	12·96	0448	0066	17·37	0390	0037	14·13	0428	0039	12·67	0246	0068	...	...	...
21	8·19	0117	0019	11·92	0363	0021	...	...	...	14·54	0553	0057	10·37	0427	0029	4·66	0072	0015
22	...	...	...	13·39	0720	0077	15·08	0425	0046	23·65	0644	0191	38·09	0791	0136	5·25	0105	0014
23	3·61	0069	0009	13·80	0429	0019	21·09	0553	0188	...	...	...	9·76	0417	0035	22·90	0763	0260
24	4·24	0096	0013	13·13	0601	0033	11·79	0495	0053	33·98	0640	0218	17·25	0560	0034	12·27	0143	0078
25	22·41	0491	0083	10·22	0495	0086	11·36	0702	0023	18·82	1044	0095	...	...	...	9·12	0304	0040
26	9·29	0240	0064	...	...	...	13·21	0493	0025	15·24	0630	0038	10·48	0255	0011	8·51	0121	0047
27	14·76	0201	0025	12·08	0470	0045	14·59	0526	0059	48·51	1546	0454	9·78	0310	0036	...	...	...
28	9·40	0178	0041	8·86	0479	0016	...	...	...	40·54	1376	0340	9·02	0286	0018	10·87	0212	0027
29				12·60	0420	0021	13·65	0733	0065	20·68	0984	0151	9·02	0282	0026	9·52	0263	0017
30				12·63	0410	0032	17·68	0659	0079	...	...	...	12·07	0328	0050	4·49	0224	0019
31										11·73	0428	0029	12·01	0297	0030	5·62	0065	0022

TABLES OF RESULTS

FROM THE

METEOROLOGICAL OBSERVATIONS

MADE AT THE OBSERVATORY OF

GENERAL SIR T. M. BRISBANE, BART.,

MAKERSTOUN.

1845 AND 1846.

TABLE I.—Daily and Weekly Means of the Temperature of the Air, as deduced from the readings of the Dry Bulb Thermometer, for 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	30·2	28·9	31·4	42·9	50·5	[50·2]	52·5	54·2	60·6	49·5	46·2	39·8
2	32·6	[27·4]	[32·3]	42·0	48·5	55·2	55·1	56·1	52·8	49·4	[41·7]	37·2
3	35·1	37·0	35·5	38·6	47·7	53·7	53·5	[55·3]	49·6	45·9	38·6	33·4
4	38·5	34·8	30·9	38·4	[46·0]	49·2	55·0	56·2	51·5	44·2	32·9	34·5
5	[36·3]	37·9	27·5	39·8	42·6	54·7	55·6	55·9	49·8	[45·2]	37·9	39·6
6	42·1	29·5	30·4	[40·5]	44·3	54·8	[56·4]	56·1	47·7	39·8	51·0	36·9
7	33·4	28·1	36·7	45·2	42·2	55·3	59·8	56·7	[51·7]	45·7	49·8	[37·9]
8	36·3	27·6	39·8	42·4	41·6	[56·5]	57·8	57·0	52·0	46·0	48·8	36·8
9	32·8	[30·0]	[34·5]	38·9	42·5	52·8	56·6	53·2	57·4	45·4	[45·3]	40·9
10	39·7	34·1	40·2	39·0	44·4	59·0	59·1	[54·8]	51·9	44·5	43·0	38·5
11	41·5	30·2	31·9	38·6	[44·7]	62·4	52·4	55·6	50·5	45·5	41·1	42·4
12	[37·3]	30·7	27·9	39·0	47·7	64·5	51·3	52·9	53·2	[49·5]	38·3	34·4
13	34·4	39·6	26·5	[40·5]	46·6	63·9	[53·2]	53·2	52·2	51·8	38·0	28·3
14	39·8	34·7	26·9	40·8	45·7	61·0	52·7	53·5	[50·7]	56·8	34·6	[36·2]
15	35·7	36·5	23·2	42·5	54·2	[60·5]	52·0	51·6	46·3	53·2	39·0	42·3
16	28·2	[35·3]	[28·4]	43·2	55·1	58·8	51·7	51·0	49·0	49·4	[40·4]	40·0
17	38·6	37·9	30·6	48·8	50·1	58·1	52·8	[52·2]	53·0	52·2	42·2	29·8
18	39·0	33·3	34·1	48·6	[49·6]	57·0	57·0	54·2	54·5	53·6	41·2	31·7
19	[35·6]	30·1	29·4	44·8	45·2	56·2	54·4	51·2	49·8	[49·6]	47·2	35·1
20	30·9	36·3	29·0	[47·0]	46·3	57·6	[53·1]	51·8	47·4	47·3	42·8	35·7
21	35·0	36·0	34·6	48·5	46·9	58·6	52·2	52·1	[46·3]	46·2	37·2	[35·8]
22	41·9	30·9	47·4	47·0	45·6	[55·4]	50·8	52·4	43·8	47·8	34·7	37·8
23	46·5	[33·5]	38·4	44·6	45·8	53·8	51·5	56·0	39·9	47·7	[40·4]	38·7
24	39·3	31·4	40·4	41·6	44·4	52·8	53·1	[54·2]	42·4	48·9	32·3	35·6
25	43·6	28·4	37·8	49·1	[45·0]	53·6	56·9	54·8	49·3	42·9	43·6	41·8
26	[34·5]	38·0	41·4	52·2	43·7	51·3	55·8	55·3	46·8	[49·0]	52·0	41·9
27	30·1	35·0	47·1	[49·4]	45·0	50·1	[53·6]	54·7	51·1	50·5	48·6	38·6
28	30·0	33·7	45·3	50·6	45·3	48·0	52·0	56·5	[48·3]	53·2	47·8	[40·8]
29	17·7		43·5	50·2	45·6	[52·0]	51·0	59·6	46·6	51·0	42·0	38·7
30	16·0		[44·0]	52·5	47·1	55·3	52·6	59·4	46·3	49·2	[41·5]	45·0
31	9·6		43·5		50·2		53·1	[56·4]		45·7		38·8

TABLE II.—Hourly Means of the Temperature of the Air for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h.	°	°	°	°	°	°	°	°	°	°	°	°
12	32·5	31·7	32·4	38·5	43·2	50·4	49·7	50·1	45·0	47·0	40·8	36·7
13	32·1	31·4	31·9	38·0	43·1	50·0	49·1	49·6	44·5	47·0	40·5	37·2
14	32·1	31·1	31·8	37·9	42·7	49·9	48·8	49·3	44·4	46·8	40·1	37·2
15	32·4	31·1	31·7	37·8	42·1	49·7	48·2	49·1	44·5	46·5	40·2	36·9
16	32·8	31·3	31·3	37·3	42·3	50·1	48·5	49·5	44·3	46·3	40·0	36·5
17	32·7	31·2	31·1	37·6	43·2	51·3	49·4	49·8	44·3	45·8	40·3	36·3
18	33·0	31·2	31·5	39·0	44·4	53·4	51·1	51·0	44·8	45·9	40·0	36·1
19	32·9	31·1	32·5	40·8	45·9	55·2	52·8	52·9	46·9	45·8	40·0	36·3
20	32·5	31·5	34·3	43·1	47·4	57·3	54·4	55·1	49·8	46·8	39·9	36·6
21	32·9	32·9	36·1	45·5	48·7	59·1	55·8	57·0	52·0	48·3	41·4	37·4
22	34·3	34·6	37·7	47·6	49·8	59·8	57·4	58·6	54·3	49·9	43·2	38·4
23	35·8	35·5	39·0	49·4	50·6	60·5	58·5	59·7	55·4	51·2	44·6	39·4
0	36·9	36·7	39·8	50·9	50·4	61·4	59·5	60·4	55·6	51·9	45·8	39·9
1	38·0	37·7	40·1	52·4	51·2	62·0	59·5	60·7	56·8	52·5	46·4	40·0
2	37·9	37·8	40·2	52·8	50·8	61·9	59·5	61·1	57·3	52·2	46·2	39·6
3	37·0	37·3	40·1	53·0	50·9	61·5	59·3	60·3	56·6	51·5	44·8	39·0
4	35·7	36·8	38·8	52·2	50·1	60·5	59·0	59·6	55·3	50·2	43·4	38·0
5	33·9	34·9	37·8	50·4	49·2	60·1	57·7	58·5	53·6	49·0	42·5	38·0
6	33·4	33·7	36·0	48·1	47·5	58·4	56·9	56·9	51·1	48·2	41·7	37·2
7	33·0	33·0	34·8	45·1	46·1	57·2	55·1	55·2	49·4	47·8	41·5	37·2
8	33·1	32·5	34·0	43·1	44·7	55·4	53·2	53·4	49·0	47·3	41·5	37·4
9	33·2	32·1	33·5	41·6	43·8	53·7	51·8	52·4	47·5	47·1	41·4	37·0
10	33·6	32·0	32·8	40·1	43·5	52·1	50·7	51·2	46·7	46·9	41·1	36·9
11	33·6	31·2	32·5	39·4	43·1	51·1	50·2	50·5	46·4	46·9	41·2	36·6

TABLE III.—Hourly Means of the Temperature of the Air for each Astronomical Quarter, and for the year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	°	°	°	°	°	h.	°	°	°	°	°
12	36·67	34·20	47·77	47·37	41·50	0	40·87	42·47	57·10	55·97	49·10
13	36·60	33·77	47·40	47·03	41·20	1	41·47	43·40	57·57	56·67	49·77
14	36·47	33·60	47·13	46·83	41·01	2	41·23	43·60	57·40	56·87	49·77
15	36·50	33·53	46·67	46·70	40·85	3	40·27	43·47	57·23	56·13	49·27
16	36·43	33·30	46·97	46·70	40·85	4	39·03	42·60	56·53	55·03	48·30
17	36·43	33·30	47·97	46·63	41·08	5	38·13	41·03	55·67	53·70	47·13
18	36·37	33·90	49·63	47·23	41·78	6	37·43	39·27	54·27	52·07	45·76
19	36·40	34·80	51·30	48·53	42·76	7	37·23	37·63	52·80	50·80	44·62
20	36·33	36·30	53·03	50·57	44·06	8	37·33	36·53	51·10	49·90	43·72
21	37·23	38·17	54·53	52·43	45·59	9	37·20	35·73	49·77	49·00	42·92
22	38·63	39·97	55·67	54·27	47·13	10	37·20	34·97	48·77	48·27	42·30
23	39·93	41·30	56·53	55·43	48·30	11	37·13	34·37	48·13	47·93	41·89

TABLE IV.—Errors of the Approximate Mean Temperatures, deduced from one or two Daily Observations, for each Month, and the Year 1845.

Months and Year.	Mean of 24 Hours.	Approximate Means (+) greater, or (−) less than true Means.								
		Max. and Min.	17h 10m and 4h 10m.	21h 40m and 10h 10m.	21h 40m and 9h 40m.	22h 10m and 11h 10m.	22h 10m and 10h 10m.	17h 10m and 23h 10m.	21h 10m and 9h 10m.	7h 10m.
	°	°	°	°	°	°	°	°	°	°
January	33·97	−0·37	+0·23	−0·37	−0·47	−0·02	−0·02	+0·28	−0·92	−0·97
February	33·35	+0·34	+0·65	−0·48	−0·45	−0·45	−0·05	0·00	−0·85	−0·35
March	35·07	+0·64	−0·12	−0·22	−0·05	+0·03	+0·18	−0·02	−0·27	−0·27
April	44·23	+0·71	+0·67	−0·91	−0·53	−0·73	−0·38	−0·73	−0·68	+0·87
May	46·45	+0·56	+0·20	−0·08	0·00	0·00	+0·20	+0·45	−0·20	−0·35
June	55·92	+0·32	−0·02	−0·15	+0·25	−0·47	+0·03	−0·02	+0·48	+1·28
July	54·00	+0·41	+0·20	−0·35	−0·08	−0·20	+0·05	−0·05	−0·20	+1·10
August	54·67	+0·43	+0·03	−0·17	+0·13	−0·12	+0·23	+0·08	+0·03	+0·53
September	49·81	+0·50	−0·01	+0·11	+0·31	+0·54	+0·69	+0·04	−0·06	−0·41
October	48·28	−0·05	−0·28	−0·28	−0·23	+0·12	+0·12	+0·22	−0·58	−0·48
November	42·02	−0·33	−0·17	−0·32	−0·25	+0·18	+0·13	+0·43	−0·62	−0·52
December	37·57	−0·27	−0·42	−0·17	−0·15	−0·07	+0·08	+0·28	−0·37	−0·37
Year	44·61	+0·24	+0·08	−0·28	−0·13	−0·10	+0·10	+0·08	−0·36	+0·01
The 12 Months.										
Mean of Errors		0·41	0·25	0·30	0·24	0·24	0·18	0·22	0·44	0·62
Range of Errors		1·08	1·09	1·02	0·84	1·27	1·07	1·16	1·40	2·25

TABLE V.—Diurnal Ranges of Temperature, as deduced from the Hourly Observations of the Dry Bulb Thermometer, on each Civil Day of 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	7·4	16·7	7·4	22·9	11·6	(29·0)	9·6	13·9	19·8	10·9	8·9	12·6
2	6·3	(26·0)	(13·0)	32·1	10·6	12·6	12·8	18·1	15·4	10·4	(15·0)	5·6
3	7·9	11·3	9·6	32·0	11·7	16·8	9·2	(15·0)	23·9	14·4	17·8	7·2
4	9·9	16·2	9·7	10·0	(16·0)	13·0	16·9	14·9	9·3	6·9	20·2	12·4
5	(7·0)	9·4	10·6	21·3	10·0	16·8	22·9	21·8	17·1	(20·0)	16·3	6·8
6	19·0	7·6	13·7	(35·0)	8·5	11·1	(21·0)	18·8	21·5	25·3	10·7	13·5
7	7·4	5·6	6·6	15·3	7·0	14·1	17·0	13·8	(25·0)	7·0	4·6	(9·0)
8	12·3	9·4	7·9	15·0	11·3	(16·0)	15·3	17·1	21·6	14·1	11·9	16·7
9	14·6	(8·0)	(11·0)	20·6	13·4	11·1	14·7	4·5	9·2	17·3	(16·0)	5·4
10	18·2	9·0	13·5	4·9	7·7	12·3	15·7	(10·0)	7·3	11·7	14·5	11·3
11	13·0	3·2	7·7	12·3	(25·0)	17·5	11·7	7·1	8·4	14·8	13·6	13·0
12	(13·0)	4·4	14·7	21·1	13·8	26·5	15·5	7·8	21·5	(18·0)	14·7	13·9
13	14·7	11·3	16·1	(17·0)	17·3	21·7	(23·0)	17·0	18·1	15·6	14·2	13·6
14	6·7	5·9	12·4	11·0	24·1	15·9	12·2	11·8	(25·0)	8·7	13·6	(25·0)
15	14·4	11·6	14·4	9·6	24·2	(22·0)	16·9	10·5	25·8	11·9	18·5	7·6
16	8·5	(10·0)	(18·0)	21·9	16·7	11·6	19·4	10·6	18·7	8·4	(8·0)	10·7
17	8·9	11·3	13·7	23·0	12·0	11·2	18·8	(18·0)	13·3	9·6	8·1	9·5
18	7·7	17·7	12·9	11·9	(17·0)	14·3	15·0	15·3	9·4	12·7	13·5	9·9
19	(9·0)	13·1	8·2	12·3	5·4	15·4	11·7	7·3	15·8	(14·0)	4·1	12·9
20	13·6	12·5	14·3	(27·0)	10·0	19·9	(6·0)	6·7	24·1	10·9	7·8	6·0
21	9·3	13·8	21·6	30·1	10·5	14·9	4·2	12·4	(14·0)	11·1	9·8	(8·0)
22	7·4	10·2	9·3	30·9	8·0	(20·0)	4·5	25·2	16·6	9·3	11·8	10·7
23	11·6	(12·0)	(16·0)	27·5	9·5	18·3	6·2	14·1	19·9	7·6	(12·0)	7·5
24	12·4	15·8	18·3	20·6	5·4	11·2	9·3	(20·0)	24·9	5·6	9·9	16·0
25	17·9	23·9	21·8	27·9	(11·0)	17·0	17·7	15·0	13·9	13·1	9·8	10·0
26	(16·0)	6·2	16·3	10·2	2·8	15·3	14·6	13·9	17·0	(14·0)	5·6	11·8
27	5·9	12·1	9·7	(12·0)	4·2	19·5	(20·0)	11·3	18·7	4·6	4·1	18·5
28	6·5	10·6	8·4	11·5	8·8	8·0	21·3	26·7	(10·0)	4·5	2·9	(18·0)
29	23·3		16·9	15·8	9·1	(22·0)	23·4	22·8	12·9	3·8	10·3	24·4
30	21·6		(15·0)	15·0	18·1	13·5	23·1	25·7	13·0	13·8	(17·0)	18·9
31	28·9		21·2		21·6		16·7	(19·0)		14·8		12·3

TABLE VI.—Extremes of Temperature for each Month from the Register Thermometers; Extremes of Daily Mean Temperature, and of Diurnal Ranges, obtained from the Hourly Observations for 1845.

Month.	Extreme Temperatures.						Extremes of Daily Mean Temperature.						Extreme Diurnal Ranges.			
	Highest.		Lowest.		Range.	Mean.	Highest.		Lowest.		Range.	Mean.	Greatest.		Least.	
	d.	°	d.	°	°	°	d.	°	d.	°	°	°	d.	°	d.	°
Jan.	5	51·2	31	−2·0	53·2	24·6	23	46·5	31	9·6	36·9	28·0	31	28·9	27	5·9
Feb.	13	44·9	1	6·7	38·2	25·8	13	39·6	8	27·6	12·0	33·6	2	26·0	11	3·2
March	31	56·2	16	15·3	40·9	35·7	22	47·4	15	23·2	24·2	35·3	25	21·8	7	6·6
April	25	65·7	6	24·2	41·5	45·0	30	52·5	4	38·4	14·1	45·4	6	35·0	10	4·9
May	15	67·0	14	31·5	35·5	49·2	16	55·1	8	41·6	13·5	48·3	11	25·0	26	2·8
June	12	78·3	1	36·6	41·7	57·4	12	64·5	28	48·0	16·5	56·2	1	29·0	28	8·0
July	10	71·6	29	35·2	36·4	53·4	7	61·5	22	50·8	10·7	56·1	29	23·4	21	4·2
Aug.	29	73·6	22	35·7	37·9	54·6	29	59·6	16	51·0	8·6	55·3	28	26·7	9	4·5
Sept.	1	75·1	24	28·1	47·0	51·6	1	60·6	23	39·9	20·7	50·2	15	25·8	10	7·3
Oct.	14	62·7	6	26·0	36·7	44·3	14	56·8	6	39·8	17·0	48·3	6	25·3	29	3·8
Nov.	6	55·8	4	24·7	31·1	40·2	26	52·0	24	32·3	19·7	42·1	4	20·2	28	2·9
Dec.	27	52·0	13	20·4	31·6	36·2	30	45·0	13	28·3	16·7	36·6	14	25·0	9	5·4

TABLE VII.—Daily and Weekly Means of the Temperature of Evaporation, as deduced from the readings of the Wet Bulb Thermometer, in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	30·0	27·6	30·2	39·3	48·0	[47·1]	50·8	51·9	57·5	46·4	43·6	37·9
2	32·4	[26·2]	[30·9]	38·9	44·2	52·3	50·3	53·5	51·0	46·8	[39·5]	35·8
3	34·2	36·0	34·2	36·7	43·9	50·3	53·0	[52·6]	46·3	45·5	36·7	32·0
4	37·1	33·5	29·6	37·6	[42·9]	46·2	50·8	53·6	49·0	43·1	30·9	33·1
5	[35·4]	35·1	26·3	37·9	39·1	52·1	50·9	52·8	47·2	[43·5]	35·7	37·2
6	39·9	26·6	28·8	[38·5]	42·0	51·1	[53·4]	53·3	45·5	37·9	48·9	35·5
7	33·0	26·3	35·0	42·8	40·5	50·9	56·9	53·8	[49·4]	44·2	47·1	[36·0]
8	35·7	26·3	38·2	39·9	39·5	[53·1]	55·1	53·2	49·6	43·8	47·7	35·7
9	31·8	[28·2]	[32·5]	36·2	41·0	49·4	53·6	52·2	55·1	43·5	[44·1]	37·7
10	37·8	33·1	37·9	37·1	42·2	56·6	54·7	[52·0]	49·8	43·3	42·8	36·7
11	39·8	28·3	29·1	36·0	[42·3]	58·4	50·3	53·3	48·6	43·7	40·5	38·3
12	[36·1]	28·9	26·1	36·7	44·3	60·0	48·9	49·9	50·5	[47·1]	37·7	32·5
13	33·7	37·7	24·1	[37·9]	42·9	58·8	[49·9]	49·4	50·6	49·7	37·1	27·8
14	38·6	32·3	25·0	38·5	43·8	57·5	50·1	50·5	[48·7]	52·1	34·2	[33·8]
15	34·8	33·6	22·5	39·3	51·7	[57·4]	47·4	47·2	44·0	50·4	38·1	39·2
16	28·1	[33·6]	[26·3]	40·1	51·3	57·1	48·1	46·5	46·4	45·7	[39·0]	36·6
17	36·8	36·2	27·8	45·2	46·1	56·9	51·6	[49·5]	52·2	50·1	39·4	28·5
18	37·2	32·2	31·1	46·9	[46·6]	54·0	54·0	52·6	52·6	49·9	40·1	31·1
19	[34·4]	29·4	27·1	42·6	42·4	52·4	52·3	50·2	46·2	[46·1]	45·2	33·7
20	29·8	34·6	25·9	[43·6]	43·8	53·2	[51·4]	50·0	44·9	43·4	40·6	34·2
21	33·5	35·0	32·7	43·5	44·6	53·8	51·5	48·2	[43·5]	42·7	35·7	[34·1]
22	40·9	29·2	45·9	42·4	43·6	[51·6]	49·3	48·9	40·8	44·8	33·2	35·5
23	44·9	[32·0]	[36·1]	41·2	44·0	49·5	49·9	53·7	36·6	44·9	[38·4]	36·0
24	38·2	29·6	36·8	40·1	43·2	50·7	50·9	[51·2]	39·9	45·5	30·2	33·9
25	42·2	26·9	36·5	45·6	[43·4]	50·0	53·1	53·3	45·8	39·8	42·1	40·0
26	[33·6]	36·9	38·6	49·1	43·2	47·2	52·6	51·6	44·3	[46·5]	48·9	40·2
27	29·4	33·6	43·4	[46·6]	44·0	47·8	[50·2]	51·3	48·3	48·3	45·9	37·0
28	29·4	31·3	41·0	47·6	42·6	46·2	47·9	52·9	[45·5]	51·0	45·8	[39·0]
29	17·4		38·5	47·2	43·1	[49·1]	47·6	56·8	44·3	49·6	39·4	37·5
30	15·7		[40·1]	49·8	43·8	52·1	49·2	56·4	44·1	46·6	[39·5]	42·4
31	9·2		39·4		46·8		50·5	[53·5]		43·6		36·8

TABLE VIII.—Hourly Means of the Temperature of Evaporation for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
12	31·7	30·5	31·0	37·6	42·2	49·2	48·7	49·0	44·1	45·1	39·3	35·1
13	31·4	30·2	30·5	37·2	42·0	48·9	48·1	48·6	43·6	45·3	39·1	35·7
14	31·3	30·0	30·5	37·1	41·5	48·7	47·7	48·2	43·5	44·9	38·7	35·5
15	31·7	30·0	30·3	36·9	40·9	48·4	47·2	48·3	43·7	44·5	38·7	35·2
16	32·1	30·1	29·8	36·5	41·1	48·7	47·5	48·4	43·5	44·4	38·8	34·7
17	32·0	30·1	29·8	36·7	41·7	49·7	48·2	48·7	43·4	44·0	39·0	34·5
18	32·2	30·0	30·2	37·9	42·7	51·3	49·7	49·5	43·9	44·0	38·8	34·4
19	32·1	29·9	31·0	39·4	43·7	52·3	50·8	50·9	45·7	44·0	38·6	34·5
20	31·8	30·2	32·3	41·2	44·6	53·7	51·7	52·2	47·9	44·8	38·8	34·7
21	32·1	31·3	33·7	42·8	45·4	54·6	52·4	53·2	49·4	46·0	39·9	35·4
22	33·3	32·4	34·4	44·1	46·1	54·9	53·3	54·0	50·7	47·0	41·2	36·4
23	34·4	33·4	35·2	45·2	46·5	55·4	53·8	54·6	51·3	47·8	42·2	36·9
0	35·4	34·2	35·6	46·0	46·2	55·9	54·4	55·2	51·3	48·3	43·2	37·4
1	36·3	34·9	35·8	46·7	47·0	56·0	54·1	55·2	51·8	48·3	43·4	37·5
2	36·1	35·1	35·8	46·8	46·8	56·1	54·3	55·3	51·7	48·3	43·4	37·2
3	35·4	34·7	35·9	46·8	46·6	55·8	54·0	54·8	51·2	47·9	42·5	36·9
4	34·4	33·9	35·4	46·2	46·1	55·3	54·0	54·7	50·8	47·1	41·6	36·0
5	33·1	32·8	34·7	45·3	45·6	55·1	53·4	54·4	49·8	46·3	40·8	36·0
6	32·4	32·0	33·6	44·0	44·5	54·2	52·9	53·9	48·5	45·8	40·1	35·5
7	32·1	31·5	32·9	42·3	43·7	53·7	52·0	52·8	47·4	45·5	39·9	35·5
8	32·2	31·1	32·3	41·1	42·8	52·7	51·0	51·6	47·0	45·2	39·8	35·7
9	32·3	30·8	31·8	39·9	42·3	51·5	50·2	50·8	46·0	45·0	39·8	35·5
10	32·6	30·6	31·4	38·9	42·1	50·5	49·4	50·0	45·4	44·8	39·5	35·2
11	32·5	29·9	31·1	38·4	41·9	49·7	49·0	49·3	45·1	44·8	39·7	34·8

TABLE IX.—Hourly Means of the Temperature of Evaporation for each Astronomical Quarter, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	°	°	°	°	°	h.	°	°	°	°	°
12	35·37	33·03	46·70	46·07	40·29	0	38·67	38·60	52·17	51·60	45·26
13	35·40	32·63	46·33	45·83	40·05	1	39·07	39·13	52·37	51·77	45·58
14	35·17	32·53	45·97	45·53	39·80	2	38·90	39·23	52·40	51·77	45·57
15	35·20	32·40	45·50	45·50	39·65	3	38·27	39·13	52·13	51·30	45·21
16	35·20	32·13	45·77	45·43	39·63	4	37·33	38·50	51·80	50·87	44·62
17	35·17	32·20	46·53	45·37	39·82	5	36·63	37·60	51·37	50·17	43·94
18	35·13	32·70	47·90	45·80	40·38	6	36·00	36·53	50·53	49·40	43·12
19	35·07	33·43	48·93	46·87	41·07	7	35·83	35·57	49·80	48·57	42·44
20	35·10	34·57	50·00	48·30	41·99	8	35·90	34·83	48·83	47·93	41·87
21	35·80	35·93	50·80	49·53	43·02	9	35·87	34·17	48·00	47·27	41·32
22	36·97	36·97	51·43	50·57	43·98	10	35·77	33·63	47·33	46·73	40·87
23	37·83	37·93	51·90	51·23	44·72	11	35·67	33·13	46·87	46·40	40·52

TABLE X.—Daily and Weekly Means of the Pressure of Aqueous Vapour, in inches of Mercury, for the Year 1845, as deduced from Tables I. and VII.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·184	0·157	0·175	0·218	0·321	[0·305]	0·364	0·372	0·446	0·295	0·271	0·225
2	·200	[·159]	[·177]	·219	·258	·371	·323	·392	·366	·306	[·239]	·212
3	·206	·219	·201	·214	·260	·339	·408	[·378]	·292	·316	·214	·183
4	·223	·195	·170	·234	[·260]	·294	·336	·393	·333	·283	·170	·191
5	[·215]	·192	·151	·225	·217	·372	·332	·376	·310	[·283]	·202	·213
6	·238	·135	·162	[·229]	·257	·347	[·386]	·387	·295	·225	·336	·210
7	·203	·145	·203	·264	·250	·336	·439	·392	[·341]	·289	·308	[·209]
8	·220	·150	·230	·235	·236	[·379]	·414	·373	·341	·277	·333	·215
9	·188	[·157]	[·185]	·201	·257	·328	·388	·391	·418	·278	[·294]	·208
10	·224	·196	·220	·218	·260	·440	·389	[·368]	·347	·283	·289	·215
11	·244	·156	·152	·201	[·259]	·451	·353	·392	·335	·281	·262	·203
12	[·218]	·160	·143	·209	·269	·473	·333	·338	·350	[·314]	·237	·182
13	·204	·223	·126	[·217]	·251	·446	[·337]	·323	·363	·346	·229	·167
14	·238	·174	·136	·225	·281	·442	·346	·346	[·337]	·348	·212	[·189]
15	·210	·178	·135	·222	·368	[·445]	·290	·290	·278	·348	·237	·222
16	·172	[·192]	[·141]	·230	·347	·456	·310	·282	·301	·281	[·242]	·197
17	·216	·212	·144	·277	·282	·458	·380	[·338]	·393	·351	·228	·163
18	·220	·189	·163	·317	[·302]	·394	·394	·390	·387	·331	·253	·187
19	[·206]	·175	·144	·264	·256	·362	·380	·365	·288	[·291]	·295	·196
20	·173	·200	·129	[·262]	·274	·367	[·373]	·353	·285	·254	·245	·199
21	·193	·211	·183	·243	·284	·371	·385	·307	[·272]	·251	·210	[·196]
22	·262	·163	·307	·235	·278	[·355]	·348	·321	·238	·278	·191	·200
23	·295	[·186]	[·209]	·238	·284	·319	·354	·397	·198	·282	[·234]	·200
24	·236	·165	·196	·268	·282	·358	·360	[·355]	·235	·282	·166	·194
25	·269	·151	·219	·282	[·281]	·333	·372	·401	·284	·228	·267	·244
26	[·211]	·225	·221	·327	·290	·293	·372	·353	·279	[·305]	·325	·247
27	·175	·195	·257	[·305]	·293	·320	[·339]	·352	·321	·327	·294	·220
28	·176	·170	·226	·310	·259	·308	·302	·372	[·290]	·361	·301	[·235]
29	·115		·195	·305	·267	[·329]	·306	·439	·281	·352	·230	·228
30	·107		[·221]	·341	·265	·365	·325	·430	·280	·303	[·241]	·258
31	·083		·213		·297		·351	[·391]		·276		·214

TABLE XI.—Pressure of Aqueous Vapour, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Pressure of Vapour.	Moon's Age.	Mean Pressure of Vapour.	After Moon farthest North.	Mean Pressure of Vapour.	After Moon farthest North.	Mean Pressure of Vapour.
Day.	in.	Day.	in.	Day.	in.	Day.	in.
15	0·273	0	0·282	0	0·249	14	0·262
16	·277	1	·271	1	·250	15	·275
17	·279	2	·271	2	·254	16	·261
18	·252	3	·269	3	·277	17	·260
19	·257	4	·257	4	·271	18	·268
20	·272	5	·245	5	·281	19	·275
21	·254	6	·270	6	·289	20	·269
22	·250	7	·278	7	·301	21	·262
23	·241	8	·275	8	·271	22	·278
24	·253	9	·285	9	·278	23	·268
25	·261	10	·282	10	·280	24	·264
26	·283	11	·284	11	·271	25	·270
27	·289	12	·277	12	·278	26	·262
28	·287	13	·270	13	·265	27	·260
29	·279	14	·282				

TABLE XII.—Hourly Means of the Pressure of Aqueous Vapour for each Month in 1845, as deduced from Tables II. and VIII.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
12	0·189	0·177	0·178	0·233	0·274	0·349	0·346	0·349	0·295	0·295	0·241	0·205
13	·188	·175	·175	·231	·271	·348	·339	·345	·290	·299	·240	·210
14	·186	·175	·176	·230	·265	·343	·333	·339	·289	·292	·237	·207
15	·190	·175	·174	·227	·259	·339	·328	·343	·292	·287	·236	·204
16	·192	·174	·169	·225	·261	·341	·332	·342	·290	·287	·239	·199
17	·191	·175	·171	·225	·264	·352	·337	·345	·288	·284	·240	·198
18	·192	·174	·174	·234	·271	·366	·354	·350	·293	·283	·239	·198
19	·191	·173	·177	·243	·276	·371	·361	·363	·308	·284	·236	·198
20	·191	·174	·179	·255	·279	·383	·366	·369	·327	·290	·241	·198
21	·191	·178	·185	·261	·282	·387	·367	·373	·337	·300	·246	·203
22	·198	·177	·180	·266	·286	·386	·372	·376	·342	·304	·254	·211
23	·201	·186	·180	·270	·285	·392	·372	·380	·344	·308	·258	·209
0	·208	·188	·180	·271	·281	·394	·377	·387	·342	·312	·267	·213
1	·213	·190	·180	·269	·290	·391	·368	·383	·341	·305	·264	·214
2	·211	·193	·179	·268	·290	·394	·374	·382	·333	·308	·267	·213
3	·207	·190	·182	·265	·284	·391	·369	·378	·328	·308	·262	·213
4	·202	·180	·187	·261	·282	·389	·372	·383	·333	·303	·260	·208
5	·198	·181	·184	·261	·281	·388	·371	·388	·328	·299	·253	·208
6	·191	·180	·184	·258	·275	·384	·367	·392	·326	·296	·247	·207
7	·190	·181	·185	·255	·274	·384	·365	·384	·320	·294	·245	·207
8	·191	·179	·182	·253	·270	·379	·361	·374	·315	·293	·244	·208
9	·191	·178	·181	·244	·269	·368	·358	·365	·309	·291	·245	·209
10	·193	·176	·181	·240	·268	·362	·351	·359	·304	·288	·242	·204
11	·191	·172	·179	·239	·268	·354	·347	·351	·301	·288	·245	·200

TABLE XIII.—Hourly Means of the Pressure of Aqueous Vapour for each Astronomical Quarter, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	in.	in.	in.	in.	in.	h.	in.	in.	in.	in.	in.
12	0·212	0·196	0·323	0·313	0·261	0	0·229	0·213	0·351	0·347	0·285
13	·213	·194	·319	·311	·259	1	·230	·213	·350	·343	·284
14	·210	·194	·314	·307	·256	2	·230	·213	·353	·341	·284
15	·210	·192	·309	·307	·254	3	·227	·212	·348	·338	·281
16	·210	·189	·311	·306	·254	4	·223	·209	·348	·340	·280
17	·210	·190	·318	·306	·256	5	·220	·209	·347	·338	·278
18	·210	·194	·330	·309	·261	6	·215	·207	·342	·338	·276
19	·208	·198	·336	·318	·265	7	·214	·207	·341	·333	·274
20	·210	·203	·343	·329	·271	8	·214	·205	·337	·327	·271
21	·213	·208	·345	·337	·276	9	·215	·201	·332	·322	·267
22	·221	·208	·348	·341	·279	10	·213	·199	·327	·317	·264
23	·223	·212	·350	·344	·282	11	·212	·197	·323	·313	·261

TABLE XIV.—Mean Relative Humidity of the Air for each Week-Day and Week in 1845, Saturation being = 1.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0·984	0·882	0·897	0·747	0·845	[0·808]	0·894	0·863	0·835	0·804	0·826	0·856
2	·980	[·894]	[·873]	·774	·727	·834	·727	·854	·891	·836	[·835]	·883
3	·924	·920	·889	·849	·754	·801	·969	[·847]	·793	·975	·849	·871
4	·888	·886	·885	·936	[·798]	·810	·760	·852	·847	·925	·825	·876
5	[·924]	·781	·888	·856	·751	·849	·735	·825	·836	[·890]	·821	·816
6	·838	·742	·862	[·847]	·837	·789	[·832]	·843	·855	·856	·870	·886
7	·967	·838	·864	·833	·877	·752	·844	·836	[·855]	·898	·830	[·851]
8	·948	·882	·875	·819	·843	[·809]	·852	·789	·852	·850	·930	·911
9	·917	[·842]	[·838]	·791	·892	·798	·831	·940	·871	·871	[·920]	·762
10	·855	·912	·827	·855	·844	·870	·766	[·838]	·872	·916	·986	·857
11	·875	·834	·768	·798	[·831]	·795	·872	·867	·882	·878	·953	·707
12	[·903]	·842	·831	·820	·780	·779	·854	·820	·841	[·856]	·952	·839
13	·940	·854	·768	[·808]	·756	·750	[·808]	·776	·903	·872	·931	·954
14	·905	·795	·819	·827	·873	·817	·846	·822	[·876]	·740	·968	[·818]
15	·925	·761	·931	·771	·854	[·836]	·725	·736	·845	·837	·929	·776
16	·989	[·856]	[·804]	·777	·782	·907	·783	·728	·834	·768	[·902]	·746
17	·857	·862	·758	·774	·752	·933	·925	[·836]	·949	·873	·800	·886
18	·863	·904	·758	·890	[·812]	·833	·833	·905	·890	·784	·917	·949
19	[·901]	·941	·791	·846	·808	·785	·876	·938	·776	[·790]	·870	·879
20	·901	·862	·721	[·777]	·833	·760	[·900]	·889	·833	·747	·842	·877
21	·869	·917	·836	·685	·845	·743	·958	·766	[·810]	·765	·875	[·861]
22	·929	·849	·898	·697	·866	[·783]	·909	·793	·788	·803	·872	·816
23	·891	[·875]	[·812]	·768	·879	·751	·901	·867	·753	·817	[856]	·791
24	·915	·846	·731	·957	·916	·871	·867	[·822]	·819	·783	·826	·855
25	·897	·863	·894	·779	[·895]	·789	·788	·911	·778	·781	·890	·865
26	[·926]	·915	·795	·813	·963	·751	·818	·790	·833	[·837]	·812	·876
27	·941	·878	·760	[·835]	·930	·853	[·803]	·804	·827	·861	·826	·873
28	·946	·802	·711	·814	·814	·883	·755	·800	[·823]	·868	·870	[·863]
29	·966		·652	·811	·832	[·821]	·793	·851	·846	·912	·813	·901
30	·955		[·726]	·838	·784	·817	·797	·838	·851	·835	[·853]	·819
31	·943		·712		·790		·846	[·835]		·857		·846

TABLE XV.—Mean Relative Humidity, Saturation being = 1, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Relative Humidity.	Moon's Age.	Mean Relative Humidity.	After Moon farthest North.	Mean Relative Humidity.	After Moon farthest North.	Mean Relative Humidity.
Day.		Day.		Day.		Day.	
15	0·846	0	0·835	0	0·843	14	0·825
16	·854	1	·847	1	·834	15	·863
17	·861	2	·839	2	·826	16	·844
18	·854	3	·846	3	·829	17	·837
19	·865	4	·848	4	·839	18	·848
20	·859	5	·839	5	·859	19	·855
21	·837	6	·842	6	·846	20	·875
22	·844	7	·852	7	·863	21	·850
23	·842	8	·853	8	·836	22	·854
24	·822	9	·844	9	·844	23	·841
25	·837	10	·829	10	·862	24	·844
26	·851	11	·843	11	·856	25	·824
27	·847	12	·845	12	·859	26	·847
28	·851	13	·849	13	·848	27	·840
29	·848	14	·863				

TABLE XVI.—Hourly Means of the Relative Humidity of the Air for each Month in 1845, Saturation being = 1.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h.												
12	0·931	0·898	0·881	0·928	0·926	0·921	0·935	0·931	0·937	0·875	0·886	0·872
13	·940	·897	·884	·939	·919	·933	·936	·937	·935	·887	·892	·875
14	·930	·907	·889	·935	·914	·922	·930	·929	·938	·872	·894	·862
15	·941	·907	·883	·927	·912	·916	·934	·948	·945	·867	·887	·861
16	·937	·897	·871	·937	·913	·909	·935	·932	·945	·872	·905	·850
17	·936	·902	·886	·926	·892	·903	·921	·930	·938	·879	·899	·853
18	·928	·897	·888	·918	·880	·874	·912	·907	·939	·873	·905	·857
19	·927	·896	·872	·893	·852	·834	·878	·881	·917	·879	·894	·853
20	·941	·888	·829	·864	·816	·801	·843	·831	·881	·866	·916	·843
21	·927	·864	·801	·816	·790	·762	·807	·789	·842	·852	·885	·842
22	·917	·808	·738	·773	·771	·742	·775	·754	·792	·817	·858	·844
23	·882	·823	·706	·738	·748	·737	·747	·734	·766	·792	·832	·807
0	·878	·800	·684	·704	·741	·719	·732	·730	·757	·784	·827	·810
1	·866	·779	·679	·664	·746	·699	·715	·715	·726	·749	·800	·811
2	·858	·788	·673	·652	·757	·707	·726	·703	·697	·766	·814	·816
3	·870	·792	·687	·640	·738	·711	·722	·716	·702	·784	·840	·835
4	·890	·763	·739	·649	·752	·731	·735	·742	·745	·806	·872	·846
5	·930	·819	·751	·692	·774	·739	·765	·779	·777	·828	·878	·846
6	·910	·849	·800	·737	·802	·774	·778	·831	·840	·843	·879	·862
7	·918	·874	·841	·807	·838	·807	·822	·863	·877	·850	·878	·862
8	·923	·882	·850	·858	·868	·844	·868	·893	·873	·862	·875	·863
9	·918	·890	·862	·871	·891	·870	·902	·901	·901	·861	·881	·878
10	·915	·884	·883	·906	·896	·903	·919	·923	·913	·857	·880	·861
11	·905	·887	·882	·923	·908	·912	·923	·924	·912	·857	·888	·851

TABLE XVII.—Hourly Means of the Relative Humidity for each Astronomical Quarter, and for the year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.						h.					
12	0·896	0·902	0·927	0·914	0·910	0	0·838	0·729	0·731	0·757	0·764
13	·902	·907	·929	·920	·914	1	·826	·707	·720	·730	·746
14	·895	·910	·922	·913	·910	2	·829	·704	·730	·722	·746
15	·896	·906	·921	·920	·911	3	·848	·706	·724	·734	·753
16	·897	·902	·919	·916	·909	4	·869	·717	·739	·764	·772
17	·896	·905	·905	·916	·905	5	·885	·754	·759	·795	·798
18	·897	·901	·889	·906	·898	6	·884	·795	·785	·838	·825
19	·891	·887	·855	·892	·881	7	·886	·841	·822	·863	·853
20	·900	·860	·820	·859	·860	8	·887	·863	·860	·876	·872
21	·885	·827	·786	·828	·831	9	·892	·874	·888	·888	·885
22	·873	·773	·763	·788	·799	10	·885	·891	·906	·898	·895
23	·810	·756	·744	·764	·776	11	·881	·897	·916	·898	·898

TABLE XVIII.—Daily and Weekly Means of the Height of the Barometer, for 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	30·031	29·727	29·699	29·937	29·257	[29·555]	29·055	29·256	30·094	29·405	29·964	29·198
2	29·886	[29·594]	[29·770]	29·889	29·383	29·559	29·411	29·230	30·066	29·439	[29·815]	29·288
3	29·614	29·788	29·642	29·791	29·469	29·153	29·468	[29·336]	30·057	29·322	30·103	29·037
4	29·741	29·922	29·789	29·857	[29·502]	29·049	29·588	29·323	30·062	29·320	29·881	29·253
5	[29·798]	29·677	29·957	29·908	29·682	29·105	29·950	29·496	30·044	[29·343]	29·502	28·870
6	29·691	29·783	30·166	[29·537]	29·638	29·038	[29·626]	29·506	30·090	29·641	29·271	29·026
7	29·964	29·873	30·185	29·628	29·585	29·462	29·688	29·463	[29·966]	29·237	29·116	[29·411]
8	29·894	29·882	30·159	29·130	29·340	[29·603]	29·567	29·480	29·899	29·099	29·220	29·659
9	29·760	[29·798]	[30·020]	28·910	29·322	29·957	29·495	29·275	29·729	29·052	[29·224]	29·689
10	29·370	29·421	30·035	29·030	29·408	30·047	29·415	[29·535]	29·970	29·122	29·193	29·969
11	29·230	29·826	29·848	29·406	[29·610]	30·008	29·458	29·497	29·931	29·286	29·195	29·631
12	[29·458]	30·006	29·726	29·463	29·524	29·970	29·656	29·708	29·830	[29·515]	29·352	30·190
13	29·397	29·522	29·610	[29·557]	29·944	29·990	[29·643]	29·787	29·606	29·904	29·650	30·191
14	29·507	29·510	29·540	29·208	30·123	29·957	29·695	29·663	[29·475]	29·972	29·767	[29·686]
15	29·482	29·717	29·758	29·978	30·089	[29·775]	29·866	29·611	29·227	29·757	29·508	29·306
16	29·725	[29·686]	[29·594]	30·255	30·047	29·566	29·770	29·686	29·279	29·683	[29·191]	29·313
17	29·656	29·667	29·545	30·234	29·957	29·610	29·677	[29·454]	28·979	29·519	28·924	29·488
18	29·329	29·801	29·497	30·116	[29·873]	29·556	29·828	29·393	28·839	29·618	28·855	29·388
19	[29·622]	29·899	29·617	30·053	29·705	29·683	29·952	29·244	29·297	[29·742]	28·441	28·632
20	29·370	29·789	29·941	[29·988]	29·746	29·899	[29·871]	29·126	29·573	29·546	28·580	28·583
21	29·857	29·573	29·993	29·972	29·693	29·829	29·976	29·571	[29·516]	29·973	29·101	[29·082]
22	29·798	29·285	29·769	29·854	29·717	[29·713]	29·935	29·804	29·505	30·116	29·341	28·839
23	29·410	[29·566]	[29·760]	29·702	29·744	29·841	29·857	29·597	29·970	30·139	[29·237]	29·217
24	29·389	29·532	29·831	29·570	29·778	29·574	29·792	[29·650]	29·912	29·939	29·804	29·835
25	29·353	29·755	29·643	29·430	[29·751]	29·450	29·682	29·505	29·396	29·983	29·452	29·845
26	[29·180]	29·405	29·381	29·006	29·579	29·549	29·582	29·509	29·436	[29·801]	29·144	29·381
27	28·951	29·756	29·221	[29·395]	29·772	29·426	[29·548]	29·916	29·301	29·586	29·319	29·274
28	28·876	29·778	29·051	29·297	29·918	29·199	29·426	30·102	[29·368]	29·616	29·190	[29·393]
29	29·101		29·782	29·558	29·796	[29·347]	29·464	30·127	29·421	29·546	29·199	29·347
30	29·036		[29·625]	29·508	29·851	29·445	29·342	30·146	29·252	29·577	[29·205]	29·126
31	29·417		29·871		29·920		29·206	[30·099]		29·863		29·388

TABLE XIX.—Diurnal Range of the Barometer for each Civil Week-Day and Week for 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·053	0·249	0·130	0·076	0·066	[0·229]	0·706	0·061	0·123	0·161	0·092	0·396
2	·313	[·268]	[·193]	·067	·265	·198	·581	·145	·042	·093	[·231]	·404
3	·162	·333	·338	·181	·123	·565	·300	[·117]	·084	·237	·077	·253
4	·332	·217	·057	·177	[·147]	·289	·540	·226	·032	·174	·370	·446
5	[·246]	·219	·268	·070	·073	·245	·132	·117	·044	[·218]	·289	·164
6	·524	·240	·087	[·220]	·099	·434	[·230]	·089	·039	·199	·263	·299
7	·040	·051	·068	·400	·257	·200	·125	·074	[·110]	·409	·227	[·308]
8	·103	·072	·119	·354	·152	[·195]	·210	·075	·158	·198	·148	·209
9	·235	[·201]	[·127]	·140	·026	·177	·076	·241	·143	·197	[·206]	·287
10	·541	·147	·228	·330	·215	·056	·105	[·138]	·244	·090	·200	·446
11	·377	·472	·171	·259	[·197]	·061	·176	·238	·130	·373	·138	·512
12	[·385]	·222	·092	·090	·310	·076	·141	·173	·092	[·183]	·258	·280
13	·303	·433	·196	[·350]	·395	·043	[·163]	·030	·397	·109	·258	·145
14	·284	·325	·200	·684	·084	·120	·344	·204	[·205]	·185	·115	[·249]
15	·570	·067	·158	·670	·039	[·085]	·075	·108	·110	·142	·299	·134
16	·163	[·184]	[·169]	·069	·146	·106	·140	·045	·146	·096	[·311]	·257
17	·156	·091	·088	·125	·061	·055	·061	[·172]	·358	·186	·343	·164
18	·391	·146	·095	·072	[·079]	·112	·201	·053	·149	·369	·289	·160
19	[·272]	·045	·278	·087	·081	·352	·036	·283	·721	[·229]	·564	·931
20	·671	·172	·301	[·116]	·083	·060	[·078]	·342	·321	·364	·658	·790
21	·170	·288	·294	·128	·067	·065	·034	·397	[·405]	·229	·307	[·687]
22	·081	·151	·160	·099	·079	[·167]	·059	·143	·568	·131	·278	0·875
23	·527	[·357]	[·269]	·185	·027	·065	·080	·140	·275	·094	[·320]	1·147
24	·527	·568	·114	·095	·056	·375	·083	[·275]	·397	·325	·207	0·221
25	·730	·523	·297	·342	[·113]	·085	·082	·296	·327	·333	·362	·297
26	[·431]	·441	·432	·225	·125	·082	·176	·297	·228	[·184]	·106	·715
27	·481	·333	·334	[·250]	·323	·383	[·115]	·378	·368	·069	·169	·696
28	·198	·031	·559	·314	·068	·353	·034	·044	[·229]	·077	·268	[·613]
29	·125		·618	·216	·123	[·358]	·043	·035	·207	·209	·445	·550
30	·177		[·350]	·311	·143	·046	·275	·042	·083	·489	[·322]	·745
31	·414		·443		·058		·067	[·062]		·067		·675

TABLE XX.—Diurnal Range of the Barometer, with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Mean Diurnal Range.	Moon's Age.	Mean Diurnal Range.	After Moon farthest North.	Mean Diurnal Range.	After Moon farthest North.	Mean Diurnal Range.
Day.	in.	Day.	in.	Day.	in.	Day.	in.
15	0·159	0	0·270	0	0·256	14	0·292
16	·190	1	·226	1	·263	15	·243
17	·261	2	·265	2	·210	16	·229
18	·277	3	·218	3	·226	17	·219
19	·285	4	·229	4	·271	18	·261
20	·316	5	·240	5	·220	19	·232
21	·337	6	·227	6	·267	20	·182
22	·254	7	·275	7	·221	21	·203
23	·309	8	·224	8	·212	22	·231
24	·322	9	·174	9	·211	23	·248
25	·149	10	·197	10	·246	24	·242
26	·270	11	·194	11	·203	25	·252
27	·234	12	·222	12	·208	26	·314
28	·255	13	·150	13	·239	27	·274
29	·227	14	·169				

TABLE XXI.—Hourly Means of the Height of the Barometer for each Month, and the Year 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
h.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
12	29·525	29·693	29·711	29·648	29·695	29·608	29·623	29·564	29·660	29·589	29·329	29·384	29·5857
13	·518	·690	·712	·641	·693	·604	·619	·563	·657	·585	·319	·375	·5813
14	·518	·688	·710	·642	·691	·600	·613	·564	·652	·583	·312	·377	·5792
15	·511	·681	·706	·638	·689	·598	·612	·561	·647	·584	·301	·372	·5750
16	·504	·680	·709	·637	·690	·600	·613	·560	·644	·585	·294	·366	·5735
17	·501	·681	·714	·640	·693	·603	·617	·566	·648	·586	·293	·366	·5757
18	·502	·683	·720	·646	·699	·603	·621	·570	·658	·593	·296	·368	·5799
19	·508	·689	·731	·649	·701	·606	·625	·575	·658	·603	·305	·371	·5851
20	·519	·700	·740	·650	·704	·607	·629	·577	·659	·611	·317	·375	·5907
21	·526	·704	·747	·653	·703	·607	·629	·580	·658	·613	·328	·381	·5941
22	·529	·708	·756	·653	·702	·605	·630	·580	·653	·615	·337	·388	·5963
23	·528	·716	·759	·651	·702	·602	·628	·580	·647	·613	·338	·384	·5957
0	·524	·713	·761	·648	·700	·598	·627	·580	·643	·608	·332	·378	·5927
1	·514	·709	·756	·643	·700	·595	·624	·580	·634	·601	·330	·370	·5880
2	·509	·704	·753	·633	·699	·592	·622	·578	·628	·600	·328	·363	·5841
3	·510	·704	·748	·627	·697	·587	·616	·578	·624	·597	·328	·361	·5814
4	·511	·705	·748	·626	·696	·585	·612	·577	·624	·599	·331	·367	·5818
5	·510	·711	·751	·628	·698	·584	·612	·577	·630	·604	·334	·366	·5837
6	·510	·716	·753	·630	·705	·586	·618	·580	·636	·609	·337	·365	·5871
7	·509	·721	·759	·638	·713	·587	·622	·588	·641	·614	·336	·360	·5907
8	·510	·724	·760	·646	·722	·593	·626	·592	·646	·616	·337	·354	·5938
9	·505	·724	·757	·645	·726	·592	·629	·597	·646	·617	·334	·354	·5938
10	·500	·726	·756	·647	·730	·592	·632	·599	·643	·615	·327	·355	·5935
11	·501	·725	·756	·647	·731	·591	·633	·598	·640	·617	·322	·357	·5932

TABLE XXII.—Reduced Hourly Variations of the Height of the Barometer for each Astronomical Quarter, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	M. T. Mak.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	in.	in.	in.	in.	in.	h.	in.	in.	in.	in.	in.
12	0·0210	0·0126	0·0166	0·0126	0·0131	0	0·0316	0·0241	0·0121	0·0124	0·0175
13	·0133	·0086	·0130	·0095	·0085	1	·0260	·0186	·0098	·0065	·0126
14	·0126	·0066	·0086	·0070	·0062	2	·0223	·0116	·0074	·0030	·0085
15	·0060	·0007	·0066	·0040	·0017	3	·0230	·0069	·0027	·0002	·0055
16	·0003	·0000	·0075	·0025	·0000	4	·0273	·0059	·0000	·0000	·0057
17	·0000	·0020	·0106	·0057	·0020	5	·0286	·0086	·0000	·0032	·0074
18	·0030	·0057	·0135	·0122	·0060	6	·0303	·0107	·0046	·0072	·0106
19	·0100	·0114	·0162	·0167	·0110	7	·0290	·0160	·0087	·0127	·0140
20	·0200	·0175	·0185	·0198	·0164	8	·0286	·0190	·0146	·0159	·0169
21	·0290	·0211	·0178	·0206	·0195	9	·0270	·0167	·0163	·0174	·0166
22	·0363	·0245	·0168	·0191	·0215	10	·0243	·0167	·0182	·0159	·0161
23	·0360	·0265	·0148	·0159	·0207	11	·0246	·0153	·0183	·0146	·0156

TABLE XXIII.—Extreme Readings of the Barometer for each Month in 1845; Extreme Daily Heights for each Month; and Extreme Diurnal Ranges for each Month, together with the Ranges and Means of the Extremes.

Month.	Extreme Readings.								Extreme Daily Means.						Extreme Diurnal Ranges.			
	Highest.			Lowest.			Range.	Mean.	Highest.		Lowest.		Range.	Mean.	Greatest.		Least.	
	d.	h.	in.	d.	h.	in.	in.	in.	d.	in.	d.	in.	in.	in.	d.	in.	d.	in.
Jan.	0	23	30·052	27	18	28·809	1·243	29·430	1	30·031	28	28·876	1·155	29·453	25	0·730	7	0·040
Feb.	11	22	30·077	25	17	29·213	0·864	29·645	12	30·006	22	29·285	0·721	29·645	24	0·568	28	0·031
March	8	23	30·244	27	21	28·839	1·405	29·541	7	30·185	28	29·051	1·134	29·618	29	0·618	4	0·057
April	16	20	30·289	9	4	28·860	1·429	29·574	16	30·255	9	28·910	1·345	29·582	14	0·684	2	0·067
May	13	19, 20	30·161	1	6	29·225	0·936	29·693	14	30·123	1	29·257	0·866	29·690	13	0·395	9	0·026
June	9, 10	22, 2	30·072	3	11	28·874	1·198	29·473	10	30·047	6	29·038	1·009	29·542	3	0·565	13	0·043
July	5	10	30·003	1	5	28·727	1·276	29·365	21	29·976	1	29·055	0·921	29·515	1	0·706	21, 28	0·034
Aug.	31	0	30·175	19	20	29·008	1·167	29·591	30	30·146	20	29·126	1·020	29·636	21	0·397	13	0·030
Sept.	0	13	30·162	18	2	28·781	1·381	29·471	1	30·094	18	28·839	1·255	29·466	19	0·721	4	0·032
Oct.	22	9	30·177	8	16	28·946	1·231	29·561	23	30·139	9	29·052	1·087	29·595	30	0·489	31	0·067
Nov.	2	13	30·138	19	13	28·239	1·899	29·188	3	30·103	19	28·441	1·662	29·272	20	0·658	3	0·077
Dec.	12	11	30·284	19	15	28·282	2·002	29·283	13	30·191	20	28·583	1·608	29·387	23	1·147	15	0·134

TABLE XXIV.—Hourly Variations of the Pressure of Dry Air for each Astronomical Quarter, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	in.	in.	in.	in.	in.	h.	in.	in.	in.	in.	in.
12	0·019	0·022	0·042	0·040	0·028	0	0·013	0·016	0·009	0·005	0·008
13	·010	·020	·042	·038	·025	1	·006	·011	·008	·003	·005
14	·013	·018	·043	·040	·026	2	·002	·004	·002	·002	·000
15	·006	·014	·046	·037	·024	3	·006	·000	·003	·002	·000
16	·000	·016	·044	·036	·022	4	·014	·002	·000	·000	·002
17	·000	·017	·041	·040	·022	5	·019	·005	·001	·005	·005
18	·003	·017	·031	·043	·021	6	·025	·009	·011	·009	·011
19	·012	·018	·028	·039	·022	7	·025	·014	·016	·020	·016
20	·020	·019	·023	·031	·021	8	·025	·019	·026	·029	·022
21	·026	·018	·021	·024	·019	9	·022	·021	·032	·035	·026
22	·025	·021	·017	·018	·018	10	·021	·023	·039	·039	·028
23	·023	·019	·013	·012	·015	11	·023	·023	·043	·042	·031

TABLE XXV.—Daily and Weekly Means of the Pressure of Wind, in Pounds on the Square Foot of Surface, deduced from the greatest pressures occurring between the Hourly Observations, in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	0·02	0·51	0·56	0·56	3·76	[1·00]	1·90	0·20	0·14	1·68	0·09	2·66
2	0·00	[0·61]	[0·43]	0·21	1·73	1·21	0·74	0·18	0·13	0·28	[0·32]	0·87
3	0·28	0·33	0·38	0·10	1·39	1·55	0·35	[0·29]	0·10	1·41	0·10	0·42
4	1·32	0·80	0·13	0·22	[1·83]	1·74	2·57	0·65	0·06	0·60	0·10	0·51
5	[0·52]	1·92	0·21	0·15	0·92	1·30	0·35	0·11	0·13	[0·54]	0·20	2·19
6	1·36	3·02	0·48	[0·30]	0·69	3·55	[0·92]	0·18	0·05	0·12	0·87	0·53
7	0·04	0·61	0·66	0·28	2·47	1·05	0·38	0·25	[0·29]	0·44	1·41	[1·00]
8	0·11	0·08	0·79	0·82	0·53	[1·49]	0·55	0·46	0·26	0·39	0·50	0·41
9	0·09	[0·91]	[0·93]	0·24	0·46	1·74	1·32	0·71	0·87	0·22	[0·49]	1·90
10	1·69	0·16	0·96	2·15	0·26	0·75	0·14	[0·49]	0·35	0·14	0·02	0·43
11	1·32	0·78	2·12	1·99	[0·55]	0·57	0·29	0·82	0·13	0·24	0·04	3·76
12	[0·63]	0·80	0·60	0·40	0·99	0·30	0·17	0·54	0·09	[0·45]	0·09	0·44
13	0·23	2·90	0·31	[1·89]	0·82	0·15	[0·32]	0·14	0·06	0·73	0·03	0·02
14	0·30	0·64	0·94	3·11	0·22	0·12	0·70	0·37	[0·15]	0·57	0·02	[1·52]
15	0·14	0·51	0·30	3·57	0·29	[0·13]	0·45	1·22	0·12	0·78	0·47	2·43
16	0·07	[0·76]	[0·50]	0·13	0·57	0·06	0·19	0·42	0·24	1·72	[0·81]	2·42
17	0·72	0·31	0·35	0·12	0·77	0·06	0·12	[0·78]	0·27	1·67	0·95	0·07
18	1·21	0·07	0·14	0·23	[0·79]	0·10	0·22	0·13	0·50	2·89	0·71	0·31
19	[0·58]	0·11	0·95	0·40	1·42	0·46	0·20	0·75	0·72	[1·99]	2·71	1·05
20	0·39	0·47	0·45	[0·27]	0·55	0·13	[0·46]	1·82	0·37	4·27	1·55	1·17
21	0·34	0·35	2·05	0·17	1·13	0·49	0·67	0·38	[0·58]	0·86	0·45	[1·41]
22	0·73	0·20	2·44	0·36	1·14	[0·35]	0·87	1·04	1·28	0·55	0·18	2·58
23	2·69	[0·44]	[1·29]	0·32	0·44	0·33	0·66	1·57	0·24	0·69	[1·10]	2·50
24	0·56	0·42	0·35	0·23	0·58	0·25	0·21	[0·87]	0·37	1·37	0·29	0·88
25	2·76	0·40	0·61	0·75	[0·87]	0·45	0·20	0·59	0·93	0·60	1·42	0·56
26	[1·13]	0·83	1·83	1·75	1·33	0·30	0·81	1·13	0·42	[0·91]	2·69	2·68
27	0·29	0·18	3·44	[1·08]	0·74	0·53	[0·35]	0·52	1·43	1·27	1·65	2·57
28	0·35	1·12	5·83	1·09	0·99	2·30	0·37	0·06	[1·08]	1·02	0·83	[1·84]
29	0·12		1·34	0·74	0·89	[1·13]	0·12	0·15	0·93	0·49	2·24	1·45
30	0·02		[2·05]	1·90	0·42	1·02	0·38	0·24	1·10	0·81	[1·44]	2·84
31	0·08		0·90		0·19		0·40	[0·14]		0·62		0·93

TABLE XXVI.—Daily and Weekly Means of the Pressure of Wind in Pounds on the Square Foot of Surface, deduced from the greatest pressures observed within 10m at the Observation Hours, in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	0·00	0·33	0·35	0·35	2·81	[0·66]	1·18	0·11	0·11	1·15	0·05	1·67
2	0·01	[0·42]	[0·30]	0·13	1·04	0·83	0·48	0·09	0·12	0·15	[0·18]	0·54
3	0·17	0·17	0·20	0·05	1·03	0·94	0·27	[0·17]	0·05	0·97	0·04	0·32
4	0·92	0·55	0·09	0·12	[1·32]	1·19	2·24	0·42	0·04	0·36	0·06	0·33
5	[0·35]	1·40	0·14	0·08	0·57	1·01	0·20	0·05	0·07	[0·35]	0·07	1·40
6	0·97	2·18	0·34	[0·18]	0·47	2·25	[0·71]	0·12	0·03	0·09	0·63	0·34
7	0·01	0·43	0·39	0·20	2·01	0·77	0·29	0·17	[0·19]	0·29	0·94	[0·68]
8	0·03	0·06	0·64	0·49	0·38	[1·05]	0·37	0·34	0·19	0·27	0·27	0·29
9	0·05	[0·65]	[0·66]	0·16	0·33	1·27	0·87	0·55	0·58	0·09	[0·32]	1·36
10	1·20	0·09	0·65	1·81	0·16	0·58	0·08	[0·35]	0·26	0·07	0·00	0·34
11	0·84	0·59	1·58	1·25	[0·35]	0·40	0·22	0·54	0·09	0·13	0·01	2·66
12	[0·42]	0·55	0·37	0·28	0·62	0·17	0·15	0·35	0·04	[0·27]	0·05	0·35
13	0·17	2·19	0·22	[1·44]	0·50	0·10	[0·20]	0·18	0·02	0·43	0·02	0·01
14	0·18	0·42	0·63	2·45	0·12	0·08	0·35	0·23	[0·08]	0·40	0·00	[1·10]
15	0·06	0·32	0·19	2·78	0·23	[0·08]	0·27	0·92	0·05	0·49	0·32	1·73
16	0·05	[0·54]	[0·34]	0·07	0·43	0·04	0·13	0·24	0·12	1·08	[0·52]	1·77
17	0·47	0·24	0·27	0·07	0·50	0·03	0·06	[0·51]	0·17	1·14	0·62	0·05
18	0·75	0·04	0·07	0·16	[0·56]	0·07	0·12	0·05	0·30	2·13	0·42	0·20
19	[0·35]	0·06	0·68	0·26	1·03	0·30	0·15	0·54	0·47	[1·29]	1·77	0·70
20	0·19	0·37	0·32	[0·19]	0·35	0·09	[0·30]	1·10	0·25	2·58	0·95	0·88
21	0·25	0·20	1·51	0·13	0·85	0·32	0·50	0·24	[0·37]	0·52	0·25	[0·99]
22	0·41	0·20	1·73	0·30	0·76	[0·22]	0·56	0·73	0·82	0·27	0·10	1·95
23	2·15	[0·31]	[0·93]	0·20	0·32	0·24	0·43	1·03	0·15	0·52	[0·76]	1·62
24	0·40	0·25	0·20	0·17	0·43	0·11	0·15	[0·60]	0·21	0·79	0·15	0·57
25	2·38	0·28	0·35	0·55	[0·61]	0·25	0·15	0·41	0·60	0·33	1·04	0·32
26	[0·91]	0·55	1·45	1·26	0·90	0·19	0·57	0·83	0·29	[0·58]	2·09	1·47
27	0·22	0·13	2·62	[0·77]	0·54	0·39	[0·25]	0·33	1·05	0·82	1·04	1·74
28	0·26	0·88	4·47	0·75	0·70	1·57	0·30	0·03	[0·72]	0·71	0·46	[1·20]
29	0·06		1·00	0·45	0·63	[0·76]	0·09	0·08	0·53	0·33	1·33	0·94
30	0·02		[1·51]	1·42	0·26	0·73	0·22	0·15	0·72	0·49	[0·89]	2·11
31	0·07		0·52		0·09		0·25	[0·09]		0·38		0·61

TABLE XXVII.—Mean Pressure of Wind with reference to the Moon's Age and Declination, for 1845.

Moon's Age.	Pressure of Wind.	Moon's Age.	Pressure of Wind.	After Moon farthest North.	Pressure of Wind.	After Moon farthest North.	Pressure of Wind.
Day.	lb.	Day.	lb.	Day.	lb.	Day.	lb.
15	0·53	0	0·86	0	0·56	14	0·55
16	0·49	1	0·67	1	0·63	15	0·53
17	0·79	2	0·70	2	0·60	16	0·42
18	0·51	3	0·52	3	0·68	17	0·49
19	0·69	4	0·51	4	0·76	18	0·54
20	0·94	5	0·38	5	0·34	19	0·59
21	0·49	6	0·42	6	0·51	20	0·50
22	0·55	7	0·55	7	0·54	21	0·45
23	0·59	8	0·50	8	0·37	22	0·32
24	0·57	9	0·48	9	0·50	23	0·65
25	0·48	10	0·44	10	0·51	24	0·55
26	0·59	11	0·33	11	0·44	25	0·82
27	0·68	12	0·48	12	0·58	26	0·92
28	0·70	13	0·40	13	0·75	27	0·69
29	0·66	14	0·39				

TABLE XXVIII.—Maximum Pressure of Wind in each Civil Day in 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	0·1	1·0	1·4	1·7	6·2	1·5	6·0	1·1	0·6	3·5	0·4	5·0
2	0·1	0·5	0·8	0·8	3·1	2·6	1·8	0·8	0·5	1·8	0·3	2·5
3	1·2	1·1	1·2	0·5	2·5	3·5	2·0	4·0	0·4	3·1	0·4	1·1
4	3·8	3·2	0·4	0·5	4·5	4·3	5·9	1·5	0·2	1·6	1·2	1·3
5	5·2	6·5	1·0	0·5	3·5	4·1	1·0	0·3	0·3	0·4	0·9	5·0
6	3·8	5·8	1·6	0·7	1·8	6·6	1·4	0·6	0·1	0·5	2·2	2·2
7	0·1	1·3	1·7	1·3	4·0	2·3	1·0	0·7	0·5	1·0	3·7	0·4
8	0·5	0·1	1·7	2·9	1·7	2·1	2·1	0·9	0·7	1·4	1·9	2·5
9	0·4	0·6	0·9	0·8	1·4	4·0	3·8	2·0	2·0	1·3	0·0	4·3
10	5·2	1·0	3·7	4·1	0·7	1·2	0·4	3·1	1·1	0·6	0·1	2·3
11	3·8	1·8	3·8	3·7	1·9	1·5	1·3	1·4	0·4	0·8	0·2	7·7
12	0·5	3·7	1·7	1·6	3·1	1·1	1·3	1·2	0·3	0·7	0·5	1·6
13	0·6	6·1	0·5	2·6	2·0	0·4	0·5	0·4	0·5	2·8	0·2	0·1
14	0·8	1·1	2·9	6·7	0·7	0·4	2·7	1·1	1·1	1·6	0·1	5·8
15	0·6	1·2	0·7	6·5	0·9	0·2	1·5	2·7	0·7	2·0	1·8	3·8
16	0·4	0·5	0·9	0·3	1·4	0·2	0·8	1·8	0·9	3·1	3·1	5·0
17	1·7	0·7	0·8	0·3	1·7	0·2	0·5	0·8	1·2	3·4	2·4	0·6
18	1·9	0·3	1·3	0·8	2·4	0·5	0·3	1·1	1·9	7·3	2·3	0·9
19	1·7	0·2	2·5	1·2	2·6	0·8	0·5	2·5	2·0	3·9	4·3	2·5
20	3·2	1·4	1·3	0·6	1·4	0·7	1·3	5·0	1·2	8·9	3·3	4·3
21	2·0	0·6	5·3	0·8	2·1	1·1	1·4	1·5	3·3	2·2	1·5	8·6
22	1·6	0·6	6·2	1·3	2·0	2·4	1·6	2·4	3·6	1·7	0·3	7·8
23	6·3	0·5	3·5	1·2	0·5	0·6	1·3	2·7	0·9	1·7	0·6	4·3
24	1·8	2·2	0·9	0·8	1·0	1·0	0·6	1·5	1·1	2·4	1·0	2·9
25	4·6	1·2	2·5	2·1	0·5	1·0	0·6	1·7	2·6	1·7	3·3	2·1
26	8·7	3·1	5·2	4·3	2·5	1·0	2·0	2·8	1·3	3·6	4·6	6·6
27	0·7	0·6	6·3	4·2	1·3	1·8	2·8	1·6	4·3	3·5	6·2	7·6
28	1·5	2·3	13·3	2·2	1·4	7·0	0·9	0·1	3·2	1·8	2·4	4·6
29	0·7		3·6	1·9	1·5	2·2	0·4	0·3	2·2	1·7	8·3	4·8
30	0·2		4·1	4·6	1·2	2·5	1·3	0·7	2·7	2·4	8·5	6·0
31	1·0		3·0		0·6		1·3	0·6		1·7		1·8

TABLE XXIX.—Means of the Maximum Pressure of Wind between the Hours of Observation, for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h. h.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
11—12	0·54	0·52	1·20	0·53	0·72	0·46	0·29	0·35	0·32	1·07	0·99	1·05
12—13	0·47	0·50	1·03	0·59	0·72	0·37	0·25	0·38	0·35	1·00	0·84	1·18
13—14	0·36	0·62	0·95	0·70	0·67	0·46	0·23	0·35	0·32	0·99	0·88	1·21
14—15	0·44	0·62	0·97	0·69	0·66	0·40	0·30	0·33	0·30	1·03	0·72	1·43
15—16	0·48	0·69	1·04	0·64	0·62	0·42	0·34	0·27	0·34	0·93	0·82	1·42
16—17	0·43	0·68	0·90	0·48	0·66	0·47	0·38	0·30	0·32	0·90	0·88	1·48
17—18	0·39	0·80	0·96	0·59	0·70	0·53	0·45	0·36	0·34	0·97	0·88	1·58
18—19	0·49	0·74	0·91	0·70	0·91	0·80	0·51	0·35	0·31	0·79	0·63	1·29
19—20	0·50	0·83	0·95	0·67	1·15	0·99	0·56	0·47	0·42	0·71	0·67	1·41
20—21	0·59	0·90	1·28	0·92	1·24	1·06	0·67	0·60	0·49	0·91	0·62	1·53
21—22	0·69	1·02	1·36	0·97	1·29	1·23	0·64	0·74	0·60	1·09	0·62	1·49
22—23	0·77	0·95	1·36	1·05	1·39	1·26	0·77	0·82	0·83	1·25	0·63	1·74
23— 0	0·83	0·86	1·37	1·05	1·32	1·50	0·81	0·81	0·76	1·29	0·71	1·66
0— 1	0·79	0·90	1·39	1·21	1·29	1·40	0·95	1·03	0·65	1·51	0·74	1·58
1— 2	0·80	0·88	1·47	1·36	1·38	1·44	0·91	0·87	0·68	1·33	0·80	1·66
2— 3	0·87	0·86	1·26	1·25	1·32	1·19	0·96	0·78	0·65	1·34	0·70	1·37
3— 4	0·87	0·84	1·16	1·32	1·27	1·15	0·98	0·83	0·67	1·17	0·65	1·44
4— 5	0·66	0·70	1·19	1·25	1·09	0·98	1·03	0·79	0·45	1·02	0·69	1·26
5— 6	0·63	0·67	1·00	1·07	1·10	0·80	0·70	0·63	0·33	0·70	0·80	1·47
6— 7	0·70	0·63	1·05	0·75	0·90	0·71	0·56	0·64	0·28	0·73	0·84	1·27
7— 8	0·66	0·47	1·08	0·61	0·81	0·67	0·43	0·48	0·29	0·64	0·88	1·35
8— 9	0·70	0·67	1·13	0·63	0·63	0·41	0·38	0·49	0·28	0·70	1·02	1·57
9—10	0·80	0·61	1·02	0·61	0·56	0·50	0·27	0·45	0·22	0·67	0·90	1·47
10—11	0·87	0·55	0·88	0·65	0·43	0·50	0·26	0·40	0·27	0·77	0·91	1·36

TABLE XXX.—Means of the Maximum Pressure of Wind between the Hours of Observation, for each of the Astronomical Quarters, and for the year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h. h.	lb.	lb.	lb.	lb.	lb.	h. h.	lb.	lb.	lb.	lb.	lb.
11—12	0·86	0·75	0·49	0·58	0·67	23— 0	1·07	1·09	1·21	0·95	1·08
12—13	0·83	0·71	0·45	0·58	0·64	0— 1	1·04	1·17	1·21	1·06	1·12
13—14	0·82	0·76	0·45	0·55	0·64	1— 2	1·09	1·24	1·24	0·96	1·13
14—15	0·86	0·76	0·45	0·55	0·66	2— 3	0·98	1·12	1·16	0·92	1·05
15—16	0·91	0·79	0·46	0·51	0·67	3— 4	0·99	1·11	1·13	0·89	1·03
16—17	0·93	0·69	0·50	0·51	0·66	4— 5	0·87	1·05	1·03	0·75	0·93
17—18	0·95	0·78	0·56	0·56	0·71	5— 6	0·97	0·91	0·87	0·55	0·82
18—19	0·80	0·78	0·74	0·48	0·70	6— 7	0·94	0·81	0·72	0·55	0·75
19—20	0·86	0·82	0·90	0·53	0·78	7— 8	0·96	0·72	0·64	0·47	0·70
20—21	0·91	1·03	0·99	0·67	0·90	8— 9	1·10	0·81	0·47	0·49	0·72
21—22	0·93	1·12	1·05	0·81	0·98	9—10	1·06	0·75	0·44	0·45	0·67
22—23	1·05	1·12	1·14	0·97	1·07	10—11	1·05	0·69	0·40	0·48	0·65

TABLE XXXI.—Hourly Means of the Maximum Pressure of Wind within 10^m at the Observation Hours, for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
12	0·36	0·40	0·71	0·35	0·45	0·24	0·15	0·18	0·20	0·60	0·58	0·86
13	0·30	0·35	0·80	0·52	0·53	0·28	0·16	0·26	0·20	0·66	0·51	0·78
14	0·26	0·40	0·60	0·48	0·49	0·24	0·14	0·23	0·18	0·63	0·37	0·69
15	0·29	0·57	0·70	0·47	0·50	0·23	0·19	0·16	0·26	0·60	0·59	0·93
16	0·29	0·51	0·76	0·47	0·42	0·32	0·32	0·21	0·20	0·57	0·40	0·95
17	0·26	0·53	0·63	0·38	0·58	0·32	0·34	0·19	0·19	0·69	0·63	0·91
18	0·24	0·64	0·71	0·56	0·58	0·52	0·30	0·23	0·18	0·53	0·48	0·91
19	0·40	0·55	0·60	0·48	0·67	0·67	0·32	0·25	0·16	0·40	0·40	0·80
20	0·34	0·64	0·89	0·52	0·91	0·67	0·63	0·41	0·25	0·45	0·49	1·03
21	0·46	0·73	0·86	0·59	0·94	0·86	0·52	0·45	0·39	0·68	0·42	1·17
22	0·52	0·79	1·13	0·81	0·99	0·86	0·48	0·58	0·49	0·79	0·46	1·14
23	0·60	0·65	1·11	0·80	0·97	1·01	0·63	0·56	0·57	0·94	0·35	1·26
0	0·63	0·60	1·04	0·86	0·90	0·95	0·64	0·60	0·45	0·85	0·50	1·10
1	0·63	0·67	0·98	0·87	0·83	0·99	0·70	0·55	0·49	1·05	0·51	1·12
2	0·54	0·66	0·93	0·97	1·01	0·85	0·57	0·57	0·44	0·84	0·51	0·99
3	0·52	0·65	0·92	0·99	0·96	0·81	0·59	0·53	0·43	0·71	0·47	1·04
4	0·52	0·47	0·81	0·96	0·80	0·69	0·74	0·66	0·37	0·76	0·34	0·87
5	0·41	0·32	0·79	0·92	0·81	0·54	0·69	0·53	0·25	0·53	0·60	0·99
6	0·51	0·54	0·62	0·62	0·73	0·55	0·36	0·40	0·19	0·43	0·46	0·90
7	0·48	0·37	0·77	0·38	0·51	0·40	0·36	0·35	0·15	0·49	0·55	0·90
8	0·55	0·29	0·74	0·45	0·49	0·32	0·20	0·33	0·21	0·41	0·72	0·91
9	0·56	0·41	0·88	0·41	0·34	0·34	0·17	0·33	0·14	0·52	0·65	1·06
10	0·57	0·38	0·73	0·43	0·32	0·34	0·13	0·27	0·17	0·44	0·61	1·18
11	0·66	0·31	0·65	0·39	0·34	0·35	0·19	0·25	0·20	0·55	0·56	0·86

TABLE XXXII.—Hourly Means of the Maximum Pressure of Wind within 10^m at the Observation Hours, for each of the Astronomical Quarters, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.	lb.	lb.	lb.	lb.	lb.	h.	lb.	lb.	lb.	lb.	lb.
12	0·60	0·49	0·28	0·33	0·42	0	0·74	0·83	0·83	0·63	0·76
13	0·53	0·56	0·32	0·37	0·45	1	0·75	0·84	0·84	0·70	0·78
14	0·44	0·49	0·29	0·35	0·39	2	0·68	0·85	0·81	0·62	0·74
15	0·60	0·58	0·31	0·34	0·46	3	0·68	0·85	0·79	0·56	0·72
16	0·55	0·58	0·35	0·33	0·45	4	0·58	0·75	0·74	0·60	0·67
17	0·60	0·51	0·41	0·36	0·47	5	0·67	0·68	0·68	0·44	0·61
18	0·54	0·64	0·47	0·31	0·49	6	0·62	0·59	0·55	0·34	0·53
19	0·53	0·54	0·55	0·27	0·47	7	0·64	0·51	0·42	0·33	0·48
20	0·62	0·68	0·74	0·37	0·60	8	0·73	0·49	0·34	0·32	0·47
21	0·68	0·73	0·77	0·51	0·67	9	0·76	0·57	0·28	0·33	0·48
22	0·71	0·91	0·78	0·62	0·75	10	0·79	0·51	0·26	0·29	0·46
23	0·74	0·85	0·87	0·69	0·79	11	0·69	0·45	0·29	0·33	0·44

TABLE XXXIII.—Number of Times which the Wind blew from each Point of the Compass at the
together with the sums of the Pres-

Wind blowing from	January.		February.		March.		April.		May.		June.	
	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.
		lb.		lb.		lb.		lb.		lb.		lb.
N.	1	0·1	7	4·7	28	21·1	18	45·2	19	22·8	10	18·1
N by E.	3	0·7	5	1·4	14	11·4	26	59·4	18	20·1	3	10·3
NNE.	2	0·2	6	2·4	28	15·8	31	43·2	86	68·2	1	2·0
NE by N.	4	3·0	2	0·3	14	8·6	16	12·7	109	67·1	2	0·3
NE.	6	0·9	3	0·4	15	5·1	36	11·0	104	65·7	16	7·6
NE by E.	1	1·2	3	0·9	5	1·6	15	4·6	18	10·7	2	1·4
ENE.	1	0·6	6	3·1	7	1·7	26	7·8	18	9·3	10	2·1
E by N.	5	1·0	3	0·4	11	5·9	31	10·5	13	6·4	2	1·0
E.	4	0·7	4	0·9	11	5·9	8	1·8	7	4·2	10	2·8
E by S.	3	0·5	...	...	2	0·8	2	0·5	2	2·0	5	2·0
ESE.	6	1·2	3	0·8	5	1·5	3	1·2	1	1·1	4	1·1
SE by E.	3	1·2	2	0·4	...	...	3	0·9	...	...	...	...
SE.	11	2·8	5	1·0	5	0·8	4	1·5	2	0·3	4	0·8
SE by S.	5	1·5	2	1·8	...	...	5	2·9	...	...	...	...
SSE.	8	3·1	17	10·2	8	1·2	15	17·6	...	...	3	0·4
S by E.	8	6·3	19	17·6	6	5·2	11	13·6	...	...	5	5·6
S.	41	33·4	23	13·6	11	2·9	12	5·9	...	...	13	17·4
S by W.	39	31·9	23	9·1	7	1·9	15	9·3	2	0·4	11	5·6
SSW.	64	66·6	51	24·5	41	50·1	40	35·2	9	10·7	47	56·2
SW by S.	26	43·8	21	11·1	34	54·3	12	12·0	6	8·9	47	55·3
SW.	58	60·2	63	43·7	35	34·6	36	29·0	24	49·4	89	66·6
SW by W.	15	4·4	15	13·2	15	39·7	14	10·2	19	23·6	35	29·5
WSW.	12	4·3	18	4·0	30	31·5	7	2·6	16	9·6	38	17·3
W by S.	10	3·9	11	4·3	13	18·6	2	0 2	7	2·7	8	1·7
W.	9	3·5	12	4·0	20	36·0	3	0·6	13	5·9	21	6·3
W by N.	6	0·8	15	16·3	17	26·3	...	...	3	1·7	7	2·6
WNW.	7	1·7	14	9·1	20	19·0	1	0·1	15	11·3	24	7·2
NW by W.	1	0·9	4	3·7	10	12·6	...	...	7	3·3	1	0·2
NW.	16	9·4	21	13·8	31	18·4	3	1·9	15	11·9	18	5·0
NW by N.	6	2·6	22	20·4	30	19·0	8	16·8	9	4·2	4	1·3
NNW.	5	2·1	32	44·9	23	17·0	2	0·2	12	7·8	13	3·4
N by W.	2	0·7	17	16·1	33	35·0	15	24·0	6	4·2	5	2·7

Observation Hours, with a Pressure of one-tenth of a pound or upwards on a square foot of surface, sures, for each Month in 1845.

July.		August.		September.		October.		November.		December.		Wind blowing from
Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	
	lb.		lb.		lb.		lb.		lb.		lb.	
9	3·0	35	26·4	10	10·0	3	0·8	3	0·4	5	3·5	N.
5	2·2	21	10·8	1	0·5	3	1·2	...	...	1	0·1	N by E.
31	12·2	21	13·5	5	1·6	25	9·5	...	...	6	1·7	NNE.
50	19·0	15	9·7	12	4·1	10	5·7	...	...	1	0·4	NE by N.
59	22·7	14	3·1	29	6·0	8	6·3	1	0·1	...	...	NE.
10	2·9	2	0·8	3	0·6	6	7·2	1	0·2	...	...	NE by E.
17	6·8	6	0·8	13	1·7	4	3·9	...	...	...	...	ENE.
2	0·7	4	0·4	10	1·5	...	...	1	0·2	...	...	E by N.
4	0·9	4	0·5	9	1·2	3	0·3	...	...	...	...	E.
...	...	1	0·1	2	0·2	1	0·1	...	...	...	...	E by S.
1	0·4	3	0·3	4	0·4	3	1·0	...	...	...	...	ESE.
...	...	...	...	...	...	3	2·5	3	0·9	...	...	SE by E.
7	2·2	2	0·3	4	0·5	10	2·2	4	2·5	1	0·1	SE.
1	0·3	1	0·1	...	...	2	0·4	6	4·4	...	...	SE by S.
15	4·5	5	0·9	10	3·5	10	2·4	14	11·3	...	...	SSE.
3	2·0	...	...	4	1·6	11	2·4	13	9·0	...	...	S by E.
15	21·8	6	1·7	11	2·9	15	2·8	35	18·5	5	2·0	S.
3	1·5	8	3·3	3	2·0	11	4·5	35	36·7	12	10·5	S by W.
26	19·6	32	17·4	48	17·3	56	26·5	68	49·2	66	70·1	SSW.
18	24·1	24	19·8	37	19·7	67	45·3	37	39·9	89	85·2	SW by S.
52	42·4	43	20·1	74	34·1	147	109·6	66	63·7	102	101·3	SW.
23	19·9	16	7·8	33	22·2	64	62·6	40	39·7	30	37·4	SW by W.
47	23·4	41	11·9	22	13·1	39	30·8	19	14·0	24	28·0	WSW.
15	3·8	16	5·2	5	0·5	12	13·3	4	3·4	18	23·0	W by S.
15	5·0	29	9·6	16	5·2	33	31·1	4	2·1	44	67·6	W.
8	1·4	9	3·0	...	...	9	15·4	1	0·4	21	29·9	W by N.
10	3·8	21	12·6	8	2·8	6	12·4	4	1·5	22	35·1	WNW.
2	0·5	7	1·5	1	1·2	...	...	4	2·8	6	14·0	NW by W.
12	3·0	26	16·3	15	7·4	4	5·7	4	0·4	20	35·5	NW.
3	0·6	14	10·7	7	7·8	...	...	2	0·7	31	50·1	NW by N.
11	3·8	33	18·1	12	5·5	2	0·3	6	1·7	14	17·0	NNW.
6	1·7	16	9·7	2	1·1	4	1·8	4	0·8	13	17·9	N by W.

TABLE XXXIV.—Number of Times which the Wind blew from each Point of the Compass with the *sums* of the Pres-

Mak. M. T.	Number of times which the Wind blew from each															
	N.	N by E.	NNE.	NE by N.	NE.	NE. by E.	ENE.	E by N.	E.	E by S.	ESE.	SE by E.	SE.	SE by S.	SSE.	S by E.
h.																
12	2	3	8	8	10	...	...	2	1	...	1	...	3	...	2	3
13	6	1	5	13	10	...	...	...	1	...	...	1	1	...	1	3
14	7	1	10	9	3	2	2	...	1	...	...	1	1	1	3	3
15	6	3	12	7	5	2	1	1	1	2	2	...	...	2	2	2
16	7	4	10	4	5	...	2	3	...	...	...	...	2	1	1	4
17	6	4	6	8	8	...	1	...	...	...	1	...	3	...	4	3
18	5	3	10	11	4	1	1	2	1	...	1	...	2	2	5	3
19	3	5	10	11	8	3	1	1	2	1	...	...	2	...	3	1
20	3	4	15	9	13	...	3	3	2	...	1	...	1	1	5	5
21	9	4	11	8	14	1	7	4	4	3	...	...	2	1	5	3
22	10	7	8	12	16	5	6	3	2	2	3	...	3	1	10	3
23	9	10	10	11	18	1	12	5	3	...	2	1	5	1	6	6
0	5	5	15	9	19	3	8	5	3	...	6	2	4	...	9	4
1	5	7	9	10	15	8	9	4	5	2	1	2	2	1	3	7
2	7	9	7	11	13	8	8	6	7	1	3	1	4	...	6	5
3	9	3	19	6	13	7	7	11	4	3	1	1	5	1	4	2
4	10	3	12	11	14	7	13	9	7	1	3	...	3	2	6	1
5	6	2	9	12	21	6	9	9	6	...	3	1	3	2	7	2
6	9	2	13	14	18	1	8	3	6	1	1	1	1	2	4	3
7	6	5	15	12	13	3	5	5	4	...	2	...	2	2	3	3
8	2	2	9	15	18	2	2	2	1	1	2	...	5	...	8	2
9	2	10	6	8	14	4	2	1	1	...	...	1	2	...	3	2
10	10	...	7	7	11	...	1	2	2	1	...	1	2	1	2	4
11	4	3	6	9	9	2	1	1	...	...	...	1	1	1	3	6
Sums	148	100	242	235	292	66	109	82	64	18	33	14	59	22	105	80

	Sums of Pressures with which the Wind blew from															
h.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
12	2·3	2·4	4·3	3·5	3·8	...	...	0·3	0·1	...	0·1	...	0·5	...	1·9	3·4
13	9·9	2·4	2·6	5·4	4·5	...	...	...	0·1	...	...	0·4	0·2	...	0·4	5·5
14	7·1	1·7	4·2	3·3	2·3	0·5	0·8	...	0·1	...	...	0·4	0·1	0·1	3·3	2·3
15	3·7	5·2	6·3	3·0	2·0	0·3	0·1	0·7	0·1	0·2	0·6	...	...	0·9	2·2	1·5
16	8·0	2·8	3·6	2·0	1·7	...	1·2	1·0	...	...	...	...	0·2	0·4	0·7	4·8
17	8·2	1·3	3·2	2·5	4·0	...	0·3	...	...	...	0·1	...	1·1	...	1·9	1·9
18	2·7	7·9	4·4	4·3	1·5	0·6	0·3	0·3	0·1	...	...	...	0·8	0·6	0·7	3·2
19	3·1	5·2	5·9	4·4	3·7	2·0	0·1	0·1	0·2	0·1	...	...	0·4	...	1·3	0·3
20	4·4	7·7	7·0	6·6	5·3	...	0·7	0·3	0·2	...	0·1	...	0·1	0·3	2·2	3·3
21	12·3	8·7	9·5	4·6	6·9	0·2	1·8	0·7	0·9	0·5	...	...	0·3	0·2	2·2	1·1
22	11·6	10·0	8·9	7·5	9·2	2·2	1·4	0·4	0·7	0·2	0·4	...	0·4	0·1	4·5	0·4
23	4·0	15·4	9·3	12·0	7·6	0·7	3·1	1·6	2·0	...	0·3	0·2	0·8	1·3	1·5	3·5
0	6·3	6·3	13·7	7·7	8·9	2·2	4·4	2·2	0·4	...	2·1	0·5	0·8	...	2·6	1·9
1	5·6	10·5	8·3	5·8	7·8	3·9	3·8	1·6	0·5	1·4	0·1	0·2	1·0	0·3	0·7	5·5
2	2·3	6·7	9·6	12·2	5·6	3·7	2·7	3·7	2·3	0·2	2·1	0·7	0·9	...	2·1	3·3
3	9·0	1·2	17·2	3·2	10·0	2·7	1·6	4·4	2·4	2·9	0·1	0·2	0·8	1·7	1·9	2·5
4	12·2	0·7	11·5	7·3	7·8	5·4	7·8	3·3	2·8	0·3	1·1	...	0·6	0·4	4·1	1·4
5	8·4	2·6	8·0	9·1	8·3	2·2	3·6	2·0	3·7	...	0·8	0·5	0·4	2·0	3·2	1·9
6	8·6	3·6	8·9	6·0	6·6	0·1	1·9	2·9	1·1	0·2	0·1	0·3	0·5	0·8	2·4	2·0
7	4·0	4·6	8·9	5·4	3·0	0·3	1·4	2·0	0·8	...	0·8	...	1·0	1·7	1·5	1·3
8	0·9	1·7	5·9	8·2	3·3	1·0	0·5	0·2	0·2	0·1	0·2	...	2·0	...	6·2	2·3
9	2·7	6·9	4·5	1·9	4·5	1·5	0·2	0·1	0·1	...	...	0·9	0·7	...	4·4	0·8
10	13·1	...	3·0	2·4	5·4	...	0·1	0·2	0·4	0·1	...	0·5	1·3	0·3	1·6	6·0
11	5·7	2·7	1·8	2·6	5·5	2·5	0·1	0·1	...	...	...	1·1	0·1	0·3	1·6	3·2
Sums	156·1	118·2	170·5	130·9	129·2	32·0	37·9	28·1	19·2	6·2	9·1	5·9	15·0	11·4	55·1	63·3

with a Pressure of one-tenth of a pound or upwards upon a square foot of surface, together sures for each Hour in 1845.

Point of the Compass at each Hour in 1845.

S.	S by W.	SSW.	SW by S.	SW.	SW by W.	WSW.	W by S.	W.	W by N.	WNW.	NW by W.	NW.	NW by N.	NNW.	N by W.	Mak. M. T.
																h.
6	9	21	16	36	14	10	6	1	1	2	2	6	4	9	3	12
14	6	14	15	32	10	13	5	9	1	7	2	8	3	5	3	13
9	6	17	19	30	16	7	4	13	4	3	2	4	4	6	4	14
6	10	21	14	30	17	16	6	8	1	1	1	6	3	6	4	15
5	10	20	22	33	9	16	2	15	3	5	1	9	3	7	2	16
6	6	19	14	26	17	8	5	15	9	4	2	6	8	7	2	17
9	7	21	16	31	13	15	4	15	3	3	1	5	11	8	3	18
12	4	20	21	34	11	16	7	15	3	3	1	3	11	7	3	19
4	2	28	24	36	11	17	4	6	5	10	2	4	8	8	5	20
10	8	21	12	32	16	12	11	10	2	9	1	8	11	5	4	21
6	10	26	17	25	18	15	7	8	7	10	1	12	6	8	2	22
9	5	27	12	39	11	8	6	13	4	11	4	12	6	8	3	23
9	11	24	20	32	14	12	6	11	7	6	3	15	3	7	8	0
8	7	24	12	41	12	22	4	10	5	11	...	13	6	7	14	1
6	7	19	24	37	19	7	6	10	5	11	1	8	3	11	15	2
6	9	24	18	35	17	6	4	8	4	8	3	19	8	5	5	3
6	8	26	18	33	17	12	5	8	4	10	3	8	3	11	4	4
11	4	23	21	28	12	14	8	12	4	7	...	8	8	5	4	5
11	8	29	18	29	15	18	3	3	5	4	4	7	3	8	3	6
8	8	23	23	34	10	17	7	7	5	8	1	6	5	8	3	7
4	4	31	16	39	8	13	1	6	6	7	1	3	5	8	9	8
9	9	33	15	27	11	9	4	5	6	2	3	3	4	6	9	9
7	5	23	15	32	9	15	3	6	2	6	2	8	4	2	7	10
7	5	14	16	35	12	15	3	5	...	4	2	4	6	3	4	11
188	168	548	418	786	319	313	121	219	96	152	43	185	136	165	123	Sums

each Point of the Compass at each Hour in 1845.

lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	h.
4·9	6·6	9·9	19·3	26·4	11·3	3·6	4·5	0·1	1·2	0·6	3·1	4·6	2·7	7·3	4·4	12
3·8	4·9	9·9	16·9	25·4	12·5	8·2	1·3	9·3	0·3	2·5	2·6	3·3	2·1	3·9	1·3	13
5·4	3·3	9·6	17·6	21·6	12·7	2·4	0·9	9·2	2·5	0·4	1·3	0·9	2·9	2·7	4·7	14
5·5	7·5	11·8	12·4	18·9	21·8	7·7	2·7	11·5	0·8	0·4	0·2	4·9	1·0	6·5	3·4	15
5·6	9·2	7·2	16·2	28·9	11·0	6·2	0·9	9·5	1·8	1·7	0·1	6·3	4·7	5·5	0·4	16
8·6	7·6	14·5	9·2	25·7	14·8	4·4	0·9	10·2	7·6	3·4	1·4	2·9	6·9	4·3	1·1	17
5·7	4·0	14·7	10·5	22·4	18·6	11·7	0·9	10·8	1·7	2·9	0·7	2·4	11·2	5·9	1·8	18
10·0	2·0	14·0	12·5	23·4	9·4	12·4	1·2	12·8	2·3	1·0	1·6	0·7	12·9	4·1	1·8	19
1·9	0·4	15·3	19·1	32·8	11·6	21·1	2·2	2·5	8·3	7·6	2·2	2·4	11·6	6·4	5·1	20
5·6	3·5	19·8	15·4	28·7	16·3	7·8	14·4	4·9	0·5	8·5	0·1	11·1	16·6	4·5	3·3	21
5·4	2·7	18·9	24·9	26·9	17·9	14·0	12·9	2·6	7·8	6·1	0·3	15·5	5·8	9·4	7·2	22
3·9	3·6	30·1	17·8	37·2	8·3	6·8	3·4	17·4	10·5	14·0	5·7	7·4	2·3	9·5	6·0	23
4·7	6·0	27·9	24·0	31·5	14·3	7·2	1·5	17·6	3·8	2·8	4·4	9·2	6·0	10·5	7·2	0
7·0	6·3	22·3	15·3	42·5	11·4	17·0	8·2	12·8	7·3	7·2	...	4·7	10·1	2·8	14·0	1
2·1	7·6	19·9	20·3	40·5	12·8	6·8	4·1	10·0	7·3	12·8	0·2	4·7	7·6	3·7	13·8	2
2·7	6·1	29·0	10·0	29·6	20·0	2·6	1·2	6·3	4·7	8·9	8·5	21·8	2·8	2·4	6·3	3
1·9	2·5	18·8	32·2	18·9	23·0	6·6	3·0	5·8	2·5	6·9	2·6	4·8	3·2	7·3	2·8	4
4·0	5·0	25·2	22·1	17·5	9·9	9·2	3·8	9·4	4·2	4·8	...	6·2	10·0	3·5	2·1	5
4·7	3·1	26·5	14·4	21·9	9·0	8·4	2·0	4·5	6·4	3·4	1·0	6·1	1·0	4·6	1·6	6
4·2	9·1	17·7	26·9	16·9	5·3	4·6	4·2	2·2	5·6	5·6	1·2	1·3	2·8	3·6	1·8	7
4·5	1·3	26·2	14·6	30·9	5·5	3·8	0·1	0·9	3·9	7·2	0·2	0·5	2·9	3·7	8·3	8
8·5	5·4	31·4	16·8	23·2	8·2	3·0	0·7	1·6	6·5	0·8	1·9	0·4	1·7	6·6	6·2	9
8·3	1·2	17·6	17·2	21·7	16·0	5·5	3·6	2·1	0·2	3·3	0·5	4·7	1·6	0·5	7·2	10
4·6	7·7	5·2	13·8	40·2	8·6	10·0	2·0	2·9	...	3·8	0·9	1·9	3·8	2·9	3·7	11
123·5	116·6	443·4	419·4	653·6	310·2	191·0	80·6	176·9	97·7	116·6	40·7	128·7	134·2	122·1	115·5	Sums

TABLE XXXV.—Sums of the Pressures of the Wind in Table XXXIII., resolved into the Four Cardinal Points of the Compass, together with the Value and Direction of the Resultant, for each Month, for each of the Astronomical Quarters, and for the Year 1845.

Period 1845.	Sums of Pressures resolved into				Resultant.			
	N.	E.	S.	W.	Sums.	Means with reference to Whole No. of Obs.	Means with reference to No. of Obs., Wind blowing.	Directions.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	°
January	18·0	13·6	223·6	125·7	234·2	0·36	0·60	S. 29 W.
February	103·5	16·6	124·2	140·1	125·2	0·22	0·28	W. 9 S.
March	158·6	35·6	166·1	281·4	245·9	0·39	0·46	W. 2 S.
April	208·4	80·5	118·9	69·7	90·1	0·15	0·21	N. 7 E.
May	248·0	144·9	70·9	110·3	180·4	0·28	0·32	N. 11 E.
June	51·1	20·2	198·5	164·0	205·9	0·34	0·45	S. 44 W.
July	62·5	46·3	120·4	107·5	84·2	0·13	0·18	W. 43 S.
August	113·4	18·2	62·8	106·6	101·9	0·16	0·21	W. 29 N.
September	40·6	14·6	84·2	93·7	90·3	0·15	0·22	W. 29 S.
October	39·3	27·7	204·3	269·4	292·7	0·45	0·51	W. 34 S.
November	6·1	11·5	231·5	150·2	264·7	0·44	0·70	S. 32 W.
December	132·5	1·0	255·6	431·3	447·6	0·69	0·84	W. 16 S.
Astron. Qrs.								
Winter	156·6	26·1	710·7	707·2	878·0	0·46	0·68	W. 39 S.
Spring	470·5	132·7	409·2	491·2	363·7	0·20	0·26	W. 10 N.
Summer	361·6	211·4	389·8	381·8	172·7	0·09	0·11	W. 9 S.
Autumn	193·3	60·5	351·3	469·7	438·6	0·24	0·30	W. 21 S.
The Year.	1182·0	430·7	1861·0	2049·9	1755·8	0·23	0·31	W. 23 S.

TABLE XXXVI.—Sums of the Pressures of Wind in Table XXXIV., resolved into the four Cardinal Points of the Compass, with the Value and Direction of the Resultant, for each Hour in 1845.

Mak. M. T.	Sums of Pressures resolved into				Resultant.			
	N.	E.	S.	W.	Sums.	Means with reference to Whole No. of Obs.	Means with reference to No. of Obs., Wind blowing.	Directions.
h.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	°
12	33·0	9·0	69·3	64·6	66·4	0·21	0·35	W. 33 S.
13	33·8	9·5	66·2	70·9	69·4	0·22	0·37	W. 28 S.
14	29·1	8·7	61·3	60·4	60·9	0·19	0·32	W. 32 S.
15	32·9	10·0	67·4	74·3	73·0	0·23	0·37	W. 28 S.
16	32·7	7·8	69·6	72·0	74·0	0·24	0·36	W. 30 S.
17	34·0	7·3	69·2	77·4	78·4	0·25	0·40	W. 27 S.
18	39·8	9·8	67·5	81·6	77·0	0·25	0·36	W. 21 S.
19	39·6	11·4	63·7	76·8	69·7	0·22	0·31	W. 20 S.
20	56·0	14·4	75·9	102·1	89·9	0·29	0·38	W. 13 S.
21	71·7	18·1	78·9	104·7	86·9	0·28	0·35	W. 5 S.
22	79·7	23·1	88·3	116·2	93·5	0·30	0·35	W. 5 S.
23	77·4	28·9	90·9	121·5	93·6	0·30	0·34	W. 8 S.
0	73·7	29·8	95·7	110·4	83·5	0·27	0·29	W. 15 S.
1	70·1	26·7	98·2	120·8	98·2	0·31	0·34	W. 17 S.
2	68·6	32·0	90·9	110·7	81·8	0·26	0·29	W. 16 S.
3	74·0	31·9	84·0	104·3	73·1	0·23	0·27	W. 8 S.
4	61·7	35·6	84·3	92·5	61·2	0·20	0·22	W. 22 S.
5	55·5	29·4	80·2	85·4	61·2	0·20	0·23	W. 24 S.
6	45·4	20·5	73·8	73·2	59·9	0·19	0·24	W. 28 S.
7	36·6	16·9	74·4	66·5	62·4	0·20	0·25	W. 29 S.
8	36·0	15·7	78·0	65·0	64·8	0·21	0·28	W. 40 S.
9	35·9	12·0	84·9	64·3	71·7	0·23	0·34	W. 43 S.
10	35·5	10·4	75·9	65·2	68·1	0·22	0·35	W. 36 S.
11	30·3	11·2	71·4	70·2	73·3	0·23	0·40	W. 35 S.

TABLE XXXVII.—Differences of the Directions of Motions of the Lower and Upper Currents of Air, as deduced from the Comparisons of the Direction of the Wind and the Motions of the Clouds.

Currents.	Quadrant N. to E.			Quadrant E. to S.			Quadrant S. to W.			Quadrant W. to N.		
	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.
		°	°		°	°		°	°		°	°
Scud *minus*	42	+14		16	+19		162	+25		47	+16	
Wind	40	−10	+ 2	3	− 9	+14	14	− 8	+22	15	−10	+ 9
	7	0		1	0		3	0		9	0	
Cir.-str. *minus*	14	+32		12	+24		110	+41		41	+29	
Wind	22	−44	−14	4	−18	+13	10	−14	+36	8	−25	+19
	1	0		0	0		3	0		3	0	
Cir.-str. *minus*	15	+27		14	+18		51	+23		23	+24	
Scud	22	−30	− 6	7	−32	+ 1	20	−17	+10	23	−27	− 1
	4	0		3	0		10	0		6	0	
Cirrus *minus*	8	+56		4	+43		40	+49		16	+32	
Wind	5	−79	+ 4	...	...	+35	9	−21	+36	4	−37	+18
	0	0		1	0		1	0		1	0	
Cirrus *minus*	5	+45		5	+69		31	+33		21	+25	
Scud	6	−54	− 9	1	−11	+55	11	−32	+15	8	−32	+ 9
	0	0		0	0		1	0		1	0	

TABLE XXXVIII.—Daily and Weekly Means of the Estimated Extent of Clouded Sky, the whole Sky covered being 10, for 1845.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7·2	3·5	9·2	6·0	5·3	[7·9]	9·9	9·2	9·2	6·1	7·7	5·9
2	9·5	[3·3]	[7·9]	5·4	6·7	9·3	5·0	9·0	8·6	9·4	[4·6]	6·0
3	8·5	3·3	9·6	3·7	7·7	8·7	9·3	[8·3]	8·1	10·0	6·5	4·6
4	6·1	4·1	8·5	10·0	[7·6]	6·5	3·9	8·1	10·0	9·6	1·0	5·8
5	[7·6]	3·1	6·3	6·1	6·0	9·5	3·7	8·1	7·1	[8·5]	2·4	4·7
6	7·5	1·6	9·5	[6·1]	9·7	7·7	[6·9]	8·3	7·9	5·0	7·2	5·9
7	7·7	7·8	9·8	6·4	10·0	8·3	8·2	8·1	[8·6]	9·9	7·4	[5·6]
8	6·2	8·9	9·9	6·9	9·0	[8·2]	7·8	5·8	8·3	7·2	9·4	8·0
9	5·1	[7·9]	[7·5]	3·3	9·0	8·2	8·6	9·7	9·2	7·6	[7·3]	1·9
10	8·9	9·8	9·4	9·9	8·8	9·0	8·8	[8·6]	9·0	8·9	9·6	7·1
11	5·0	10·0	2·7	7·4	[7·5]	6·3	9·0	9·9	9·5	8·1	5·9	5·0
12	[7·4]	9·2	3·9	7·2	6·1	4·3	8·3	9·8	6·2	[8·8]	4·6	3·7
13	9·2	8·3	3·1	[7·4]	4·9	1·1	[8·0]	8·4	9·3	10·0	7·7	3·3
14	9·0	5·3	4·9	9·1	7·1	7·2	8·8	9·6	[7·5]	9·5	6·8	[5·1]
15	7·0	9·0	6·4	6·4	9·2	[7·1]	6·5	8·4	4·7	8·6	7·4	5·5
16	5·7	[7·1]	[6·0]	4·2	8·3	10·0	6·8	9·7	5·7	4·9	[7·4]	6·7
17	9·8	9·6	9·8	8·4	7·6	10·0	9·4	[9·4]	9·6	10·0	6·3	6·6
18	8·2	6·5	6·8	10·0	[8·8]	10·0	8·8	9·0	8·8	6·5	7·5	7·6
19	[7·2]	3·7	4·7	5·3	8·8	7·6	9·9	9·9	7·6	[6·3]	8·5	5·9
20	3·6	8·2	1·1	[4·6]	9·1	7·8	[9·7]	10·0	7·7	4·0	6·0	8·3
21	8·0	7·4	7·7	0·3	9·8	7·0	10·0	8·2	[6·6]	7·2	3·9	[6·7]
22	7·8	8·5	9·9	0·1	9·9	[7·3]	10·0	6·5	7·4	5·1	3·0	5·5
23	9·6	[7·2]	[6·1]	3·5	10·0	5·7	10·0	7·3	1·8	8·5	[6·1]	6·4
24	6·3	5·4	3·5	6·9	10·0	8·7	10·0	[7·5]	6·4	9·1	5·7	6·4
25	8·5	3·9	7·5	9·3	[9·9]	7·0	9·0	9·3	7·5	2·5	9·2	7·2
26	[8·0]	9·7	6·9	8·3	10·0	7·8	9·8	6·5	3·7	[8·1]	8·9	7·6
27	9·1	6·9	6·4	[8·4]	10·0	8·6	[7·8]	7·3	7·6	9·9	7·7	8·1
28	8·9	6·9	5·0	8·9	9·3	8·7	5·2	1·7	[5·9]	8·5	9·8	[7·2]
29	5·5		1·8	7·7	9·6	[7·8]	7·0	3·6	5·9	10·0	4·0	7·5
30	4·3		[4·5]	9·3	6·8	7·0	5·7	5·9	4·7	4·6	[6·3]	6·3
31	1·3		2·3		6·6		7·4	[6·2]		5·6		6·6

TABLE XXXIX.—Mean Extent of Clouded Sky, with reference to the Moon's Age and Declination, as deduced from the Six Hourly Observations nearest Midnight, for the years 1844 and 1845.

Moon's Age.	Extent of Clouded Sky.		Moon's Age.	Extent of Clouded Sky.		After Moon farthest North.	Extent of Clouded Sky.		After Moon farthest North.	Extent of Clouded Sky.	
	1844.	1845.		1844.	1845.		1844.	1845.		1844.	1845.
Day.			Day.			Day.			Day.		
15	6·28	6·62	0	5·99	6·55	0	7·49	6·22	14	7·00	7·03
16	8·30	7·32	1	6·63	5·29	1	7·24	6·61	15	6·65	7·09
17	6·37	6·87	2	6·81	6·42	2	7·64	5·47	16	5·63	6·76
18	7·26	8·07	3	7·47	6·14	3	6·57	6·75	17	5·76	6·92
19	7·34	5·83	4	6·03	7·65	4	6·43	5·96	18	7·20	5·51
20	7·51	8·28	5	6·74	4·38	5	6·61	6·36	19	6·88	7·32
21	5·94	7·06	6	7·59	6·82	6	6·53	5·64	20	6·80	7·16
22	8·02	6·17	7	6·45	7·11	7	6·86	7·05	21	5·34	7·13
23	6·15	5·04	8	7·60	5·61	8	6·33	6·96	22	5·11	8·19
24	4·74	6·39	9	6·57	7·22	9	6·09	6·62	23	6·10	7·68
25	5·74	5·52	10	5·74	8·36	10	5·79	6·54	24	6·61	6·03
26	7·66	5·48	11	6·16	7·20	11	5·90	6·66	25	7·24	6·42
27	6·42	6·91	12	5·25	7·52	12	7·52	6·48	26	6·92	6·67
28	5·04	6·74	13	6·93	6·63	13	7·47	7·22	27	6·97	6·14
29	6·14	7·01	14	5·51	7·71						

TABLE XL.—Hourly Means of the Estimated Extent of Clouded Sky, for each Month in 1845.

Mak. M. T.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
h.												
12	6·1	6·1	6·2	6·0	7·6	6·7	7·7	7·0	6·3	7·4	6·6	6·0
13	6·6	5·2	5·4	6·0	7·9	6·8	7·6	6·5	6·0	8·2	6·2	6·0
14	7·1	5·7	6·3	6·5	7·7	7·1	7·6	7·5	6·6	7·7	6·2	5·3
15	8·0	6·8	6·5	6·7	7·9	7·7	7·4	8·6	6·3	7·6	6·5	5·1
16	8·0	6·5	6·2	6·8	8·0	7·1	7·6	8·7	6·8	8·2	6·4	5·4
17	7·9	6·3	6·1	7·4	7·8	7·1	8·0	8·9	7·6	7·9	6·7	6·2
18	7·3	6·3	6·5	7·6	8·8	7·7	8·1	8·3	7·6	7·6	6·1	5·1
19	7·7	6·8	6·2	8·0	9·0	7·8	8·4	7·8	8·0	7·8	6·4	6·3
20	7·3	6·9	6·9	7·6	9·0	8·0	8·1	7·5	8·3	8·3	6·4	6·5
21	7·6	6·9	6·6	7·8	9·3	8·9	8·2	7·8	8·5	8·3	7·0	7·2
22	7·6	6·0	7·0	8·0	9·4	8·6	8·1	8·1	8·9	7·9	7·0	7·1
23	7·8	6·7	6·8	7·1	9·2	8·1	8·4	8·5	8·8	7·4	6·7	7·5
0	7·7	7·2	6·9	6·7	9·3	8·2	8·2	8·7	8·2	7·7	7·1	7·5
1	7·7	7·7	6·9	6·5	9·4	8·0	8·5	8·7	8·3	7·8	7·8	6·7
2	8·0	7·9	6·9	6·3	8·7	8·3	8·3	8·8	7·4	7·6	7·2	6·8
3	7·8	7·7	7·1	6·4	8·6	8·3	8·2	8·7	7·5	7·8	7·2	7·4
4	7·5	7·7	6·8	5·7	8·2	8·0	8·2	8·7	7·5	7·7	6·8	7·4
5	6·9	7·6	7·1	5·5	7·8	7·7	7·9	8·5	7·0	8·3	5·7	5·9
6	6·2	6·4	6·8	5·6	7·8	7·8	8·5	7·9	7·3	7·7	6·1	5·7
7	5·4	6·2	6·3	5·3	7·5	7·6	8·2	8·0	7·3	7·0	6·7	4·5
8	6·4	6·6	5·7	5·2	7·7	7·7	8·1	8·0	7·0	6·9	7·1	5·1
9	6·4	6·7	5·5	5·6	8·0	7·1	8·0	7·1	6·5	6·3	6·1	5·6
10	6·3	6·3	5·5	6·0	7·8	7·2	7·5	6·6	6·6	7·1	5·9	4·7
11	6·7	6·2	5·8	6·7	7·8	6·7	7·9	6·9	6·6	7·3	5·6	4·7

TABLE XLI.—Hourly Means of the Estimated Extent of Clouded Sky for each of the Astronomical Quarters, and for the Year 1845.

Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.	Mak. M. T.	Nov. Dec. Jan.	Feb. March. April.	May. June. July.	Aug. Sept. Oct.	Year.
h.						h.					
12	6·2	6·1	7·3	6·9	6·64	0	7·4	6·9	8·6	8·2	7·78
13	6·3	5·5	7·4	6·9	6·53	1	7·4	7·0	8·6	8·3	7·83
14	6·2	6·2	7·5	7·3	6·77	2	7·3	7·0	8·4	7·9	7·68
15	6·5	6·7	7·7	7·5	7·09	3	7·5	7·1	8·4	8·0	7·72
16	6·6	6·5	7·6	7·9	7·14	4	7·2	6·7	8·1	8·0	7·52
17	6·9	6·6	7·6	8·1	7·32	5	6·2	6·7	7·8	7·9	7·16
18	6·2	6·8	8·2	7·8	7·25	6	6·0	6·3	8·0	7·6	6·98
19	6·8	7·0	8·4	7·9	7·52	7	5·5	5·9	7·8	7·4	6·67
20	6·7	7·1	8·4	8·0	7·57	8	6·2	5·8	7·8	7·3	6·79
21	7·3	7·1	8·8	8·2	7·84	9	6·0	5·9	7·7	6·6	6·57
22	7·2	7·0	8·7	8·3	7·81	10	5·6	5·9	7·5	6·8	6·46
23	7·3	6·9	8·6	8·2	7·75	11	5·7	6·2	7·5	6·9	6·57

TABLE XLII.—Quantity of Rain for each Month of 1845, by the Observatory, Garden, and Greenhouse Gauges.

Month.	Observatory Gauge.	Garden Gauge.	Greenhouse Gauge.
	in.	in.	in.
January	1·325	1·13	0·94
February	0·712	0·81	0·57
March	1·283	1·05	0·90
April	1·261	1·12	0·85
May	2·217	1·70	1·82
June	2·935	2·59	2·38
July	1·460	1·30	0·99
August	3·158	2·89	2·41
September	1·838	1·65	1·47
October	4·247	3·97	3·54
November	1·699	1·53	1·14
December	1·853	1·40	0·85
Sums	23·988	21·14	17·86

TABLE XLIII.—Daily and Weekly Means of the Temperature of the Air, as deduced from the Readings of the Dry Bulb Thermometer, for 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	36·7	[44·3]	[48·3]	44·2	50·2	61·7	57·9	63·5	52·4	52·5	[47·1]	35·4
2	31·4	41·6	47·5	46·9	53·3	65·8	62·0	[62·8]	57·5	47·5	50·1	20·4
3	39·1	46·1	47·9	40·1	[48·2]	66·9	60·9	66·3	59·4	47·2	51·2	29·0
4	[38·9]	37·6	46·9	35·0	43·0	68·6	61·8	64·1	61·6	[51·1]	51·5	27·7
5	33·9	39·4	41·3	[40·2]	49·3	68·2	[57·9]	62·7	60·4	56·6	48·5	37·7
6	45·2	39·9	38·5	39·0	49·0	67·1	55·1	64·0	[59·9]	53·7	49·1	[34·7]
7	47·1	41·3	40·3	39·7	48·3	[64·6]	54·9	61·0	63·1	49·4	46·7	36·0
8	48·1	[37·0]	[41·2]	40·5	51·1	59·7	52·9	65·4	59·7	49·1	[42·2]	38·1
9	44·0	33·0	38·9	39·6	51·7	61·8	54·1	[61·0]	55·4	52·5	38·5	39·5
10	45·6	29·8	45·1	42·4	[50·9]	62·1	58·6	58·9	51·6	55·8	34·2	35·5
11	[41·0]	38·7	43·3	42·9	51·2	59·2	56·5	57·9	61·5	[48·9]	36·5	28·8
12	36·1	38·7	46·1	[45·0]	53·1	60·7	[59·5]	58·7	59·8	49·8	43·3	29·7
13	33·2	39·8	47·0	51·2	49·9	64·1	64·0	59·9	[57·4]	43·5	43·6	[30·0]
14	39·0	42·4	45·9	49·7	49·2	[63·4]	62·1	55·2	57·6	42·8	40·6	25·7
15	40·2	[41·8]	[40·8]	44·5	49·0	63·4	62·0	57·1	57·7	46·7	[43·6]	29·4
16	32·2	44·8	42·7	48·1	47·5	64·9	60·6	[57·9]	56·5	46·1	40·1	31·0
17	38·6	42·6	33·6	46·6	[49·7]	68·2	57·4	59·8	57·2	51·1	46·8	26·8
18	[39·3]	42·4	29·3	44·0	48·9	67·8	54·5	57·9	50·2	[48·4]	47·4	28·5
19	41·0	41·7	21·3	[43·6]	51·4	68·3	[57·8]	57·6	52·8	51·0	46·4	41·8
20	43·9	40·8	28·2	42·3	52·0	54·7	57·5	57·3	[52·9]	48·5	48·6	[33·7]
21	39·8	47·6	32·8	39·3	51·2	[61·1]	58·4	60·5	53·2	46·9	44·0	38·1
22	42·7	[46·6]	[33·0]	41·3	52·9	65·9	58·3	60·5	48·5	47·1	[44·5]	33·7
23	40·3	50·1	37·1	43·0	52·9	57·5	59·7	[56·9]	55·7	42·8	39·2	33·4
24	39·3	51·3	40·2	43·7	[52·7]	52·5	57·3	54·8	55·1	43·6	46·3	26·6
25	[43·1]	47·9	38·6	45·8	56·0	52·8	57·8	53·5	57·1	[42·7]	42·3	29·0
26	47·2	48·1	38·7	[42·6]	52·6	53·0	[60·6]	54·9	53·0	38·1	43·8	28·8
27	45·5	50·7	41·4	40·4	50·8	57·8	64·5	55·5	[52·1]	38·3	39·5	[32·2]
28	43·5	48·6	38·6	39·9	51·9	[56·2]	65·5	57·8	45·7	46·3	31·6	36·6
29	45·1		[40·7]	43·0	56·6	59·3	58·6	57·9	49·4	41·3	[33·3]	37·5
30	46·3		41·2	44·3	57·6	56·7	60·9	[56·3]	52·2	39·3	29·4	34·6
31	49·3		40·1		[60·1]		59·3	56·8		49·2		40·1

TABLE XLIV.—Mean Temperature of the Air at the Observation Hours for each Month, for each Astronomical Quarter, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
	°	°	°	°	°	°	°	°	°
January	39·8	39·7	40·3	42·9	44·0	42·9	42·0	41·3	41·2
February	40·7	40·0	42·4	45·4	46·6	45·9	43·6	42·6	41·9
March	35·9	36·8	40·9	44·4	45·2	44·7	42·6	39·1	37·6
April	38·7	41·6	44·8	46·6	47·5	47·8	46·1	43·1	41·1
May	45·9	50·0	53·7	55·9	56·5	57·1	55·0	51·7	48·2
June	53·7	59·0	65·8	69·3	70·9	68·9	67·9	63·7	58·3
July	55·5	58·5	60·9	62·6	63·2	63·3	61·7	58·8	56·3
August	53·5	56·8	61·1	63·9	65·1	66·2	64·4	60·0	56·4
September	49·3	52·2	57·6	61·6	62·8	62·5	60·1	55·8	53·2
October	44·2	44·5	48·3	51·3	52·6	52·1	48·7	46·7	45·3
November	41·8	41·0	42·5	45·2	46·2	45·4	43·4	43·2	42·8
December	31·1	31·3	32·6	34·7	35·6	34·8	32·9	32·2	31·6
Nov., Dec., Jan.,	37·57	37·33	38·47	40·93	41·93	41·03	39·43	38·90	38·53
Feb., Mar., Apr.,	38·43	39·47	42·70	45·47	46·43	46·13	44·10	41·60	40·20
May, June, July,	51·70	55·83	60·13	62·60	63·53	63·10	61·53	58·07	54·27
Aug., Sept., Oct.,	49·00	51·17	55·67	58·93	60·17	60·27	57·73	54·17	51·63
The Year	44·17	45·95	49·24	51·98	53·02	52·63	50·70	48·18	46·16

TABLE XLV.—Diurnal Ranges of Temperature for each Day in 1846, as deduced from the Observations of the Maximum and Minimum Register Thermometers.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	4·9	5·3	9·8	10·7	15·6	36·5	13·8	18·3	27·3	20·8	4·2	15·5
2	9·2	11·2	7·8	18·5	9·4	34·3	15·6	13·0	18·2	27·5	9·1	8·8
3	15·2	10·9	11·1	3·7	14·7	34·5	11·3	17·8	20·6	20·0	11·1	23·2
4	4·1	9·8	2·9	15·1	2·8	32·7	15·9	22·0	18·4	18·8	12·8	6·7
5	8·5	7·1	14·7	14·1	19·0	34·3	35·8	17·8	21·0	12·2	13·3	22·5
6	19·2	14·6	18·3	12·6	11·9	29·9	8·4	30·0	22·1	7·8	7·2	8·0
7	2·9	7·0	13·8	8·6	20·6	17·0	16·5	16·9	20·2	13·0	13·1	5·1
8	5·0	6·0	18·4	8·3	18·7	15·8	12·5	17·2	15·4	14·4	4·8	12·6
9	5·5	5·5	21·8	24·6	28·4	21·0	8·0	17·6	19·3	12·3	4·6	9·5
10	6·7	16·6	13·0	20·2	10·1	17·8	20·8	16·3	27·0	8·1	17·1	14·6
11	12·1	14·5	7·4	19·5	18·9	17·4	18·0	16·6	28·6	16·8	18·1	5·4
12	2·9	17·1	21·1	18·7	26·7	23·1	16·3	15·5	17·0	3·8	6·9	4·5
13	11·9	16·9	10·3	19·1	16·7	23·5	15·0	15·3	27·0	9·3	3·4	5·6
14	9·9	9·5	12·3	18·4	11·3	26·6	27·4	25·4	24·8	11·4	2·2	13·7
15	9·8	10·7	14·1	3·5	27·7	25·7	17·7	14·9	23·9	11·8	3·3	8·0
16	6·7	7·4	8·4	13·4	25·8	29·5	14·1	18·8	25·2	16·7	14·5	6·7
17	13·7	8·3	8·2	6·1	13·4	34·5	11·9	17·3	21·4	10·8	15·1	19·3
18	2·0	13·8	6·4	8·7	19·9	29·2	21·5	15·6	17·6	6·6	10·7	31·7
19	9·6	5·6	27·1	12·8	15·2	30·6	18·4	21·5	24·0	7·9	8·4	8·9
20	3·9	8·1	13·9	18·3	16·7	10·5	17·7	16·4	10·9	11·9	9·5	5·0
21	10·9	11·7	22·8	20·4	24·9	34·5	18·8	14·7	8·3	18·4	5·1	4·2
22	7·0	13·7	16·1	17·5	18·6	31·3	14·9	20·9	25·8	8·8	6·3	5·6
23	14·9	4·3	16·3	12·2	12·5	7·5	17·2	4·0	13·5	7·6	9·8	6·5
24	10·1	8·7	19·1	5·8	17·8	17·9	13·5	18·4	17·9	12·6	14·6	9·5
25	15·2	6·6	19·8	12·1	12·7	26·2	17·3	32·9	11·0	11·0	8·2	11·6
26	4·6	15·8	16·6	10·1	15·4	27·5	20·2	26·9	22·3	22·7	4·5	11·9
27	7·5	13·5	15·0	17·2	11·3	20·6	19·9	27·0	13·3	23·2	4·5	11·8
28	9·6	16·8	13·6	16·7	24·5	25·6	16·2	21·2	20·7	14·6	14·1	20·4
29	6·6		12·1	24·9	31·4	18·7	9·5	15·8	4·9	13·0	8·3	7·3
30	11·4		20·3	16·9	20·4	11·9	16·7	24·7	12·9	19·8	4·2	7·9
31	5·9		24·2		29·0		12·9	12·3		16·9		8·4

TABLE XLVI.—Extremes of Temperature for each Month in 1846, from the Register Thermometers; Extremes of Daily Mean Temperature for each Month, deduced from the Daily Observations; and Extreme Diurnal Ranges for each Month, from the Register Thermometers.

Month.	Extreme Temperatures.						Extremes of Daily Mean Temperature.						Extreme Diurnal Ranges.			
	Highest.		Lowest.		Range.	Mean.	Highest.		Lowest.		Range.	Mean.	Greatest.		Least.	
	d.	°	d.	°	°	°	d.	°	d.	°	°	°	d.	°	d.	°
Jan.	30	51·4	2	25·4	26·0	38·4	31	49·3	2	31·4	17·9	40·3	6	19·2	18	2·0
Feb.	27	58·0	10	21·5	36·5	39·7	24	51·3	10	29·8	21·5	40·5	12	17·1	23	4·3
March	14	53·7	19	5·4	48·3	29·5	3	47·9	19	21·3	26·6	34·6	19	27·1	4	2·9
April	12	61·2	9	27·1	34·1	44·1	13	51·2	4	35·0	16·2	43·1	29	24·9	15	3·5
May	29	71·0	16	33·5	37·5	52·2	30	57·6	4	43·0	14·6	50·3	29	31·4	4	2·8
June	19	85·4	26	37·0	48·4	61·2	4	68·6	24	52·5	16·1	60·5	1	36·5	23	7·5
July	5	80·5	5	44·7	35·8	62·6	28	65·5	8	52·9	12·6	59·2	5	35·8	9	8·0
Aug.	6	80·3	25	37·0	43·3	58·6	3	66·3	25	53·5	12·8	59·9	25	32·9	23	4·0
Sept.	5	74·3	22	33·2	41·1	53·7	7	63·1	28	45·7	17·4	54·4	11	28·6	29	4·9
Oct.	1	65·5	27	25·5	40·0	45·5	5	56·6	26	38·1	18·5	47·3	2	27·5	12	3·8
Nov.	4	55·8	28	23·0	32·8	39·4	4	51·5	30	29·4	22·1	40·4	11	18·1	14	2·2
Dec.	19	45·8	18	10·6	35·2	28·2	19	41·8	2	20·4	21·4	31·1	18	31·7	21	4·2

TABLE XLVII.—Daily and Weekly Means of the Temperature of Evaporation, as deduced from the Readings of the Wet Bulb Thermometer, in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	33·7	[42·2]	[45·9]	42·8	48·1	54·5	55·0	61·5	48·9	50·4	[45·5]	34·2
2	29·4	39·0	44·2	44·7	47·6	59·8	56·9	[60·7]	54·6	45·8	47·5	20·2
3	37·7	44·1	46·4	38·1	[45·4]	59·6	58·3	62·9	56·6	44·6	49·4	27·9
4	[37·0]	36·1	44·0	33·6	41·3	60·6	58·2	60·5	59·1	[48·8]	49·6	26·6
5	32·8	36·9	39·2	[38·4]	47·4	59·4	[54·4]	60·6	58·0	54·1	47·4	36·0
6	43·7	38·3	37·2	36·6	46·7	57·7	53·3	60·2	[57·2]	50·8	47·1	[33·4]
7	44·8	38·4	37·8	37·8	44·2	[58·4]	49·4	60·6	60·1	46·9	45·2	34·0
8	46·3	[35·1]	[39·2]	39·5	45·8	57·2	50·5	63·8	57·1	47·2	[41·2]	37·4
9	42·2	31·7	37·3	37·4	47·4	57·7	53·1	[58·3]	52·3	51·2	37·8	38·3
10	43·4	29·0	42·2	39·8	[46·5]	58·1	54·7	56·0	48·4	53·5	33·7	33·1
11	[39·6]	36·6	41·5	41·6	46·4	54·2	51·9	54·8	58·4	[46·9]	36·1	26·6
12	35·2	37·0	43·9	[43·2]	47·9	55·8	[56·1]	54·7	57·7	48·1	42·3	28·3
13	32·7	37·7	43·3	48·7	47·2	58·2	60·6	57·5	[55·1]	40·0	42·3	[28·3]
14	38·0	39·2	42·5	47·3	45·8	[57·3]	58·1	51·1	56·0	41·6	39·1	24·2
15	39·3	[39·2]	[38·0]	44·2	44·9	57·4	58·4	55·6	55·6	45·9	[42·1]	28·2
16	32·1	42·2	39·9	46·5	43·5	57·9	57·9	[55·6]	54·8	45·6	38·2	29·4
17	38·1	39·9	29·9	45·9	[46·1]	60·2	54·5	57·3	54·7	50·6	45·4	25·8
18	[38·4]	39·5	28·5	42·3	47·2	62·6	51·8	56·7	47·6	[47·3]	45·5	27·4
19	39·9	39·0	20·2	[42·0]	46·9	62·1	[54·7]	55·4	51·1	49·8	44·3	41·2
20	42·5	38·4	26·9	39·8	48·3	51·1	53·8	56·0	[50·6]	46·8	46·2	[32·8]
21	38·6	46·0	31·5	38·0	48·9	[56·5]	56·5	57·8	50·0	45·4	42·0	37·7
22	42·5	[44·5]	[31·7]	39·5	50·1	58·0	53·8	58·0	45·6	45·7	[42·9]	32·6
23	39·9	48·3	35·7	41·0	50·7	56·4	57·3	[54·4]	54·9	38·8	38·0	32·3
24	38·8	49·4	38·8	42·8	[49·1]	48·9	52·6	52·0	54·3	42·3	45·3	25·6
25	[42·1]	45·7	37·1	44·1	51·7	49·6	53·5	50·7	54·5	[41·1]	41·9	27·5
26	46·0	45·6	37·1	[40·1]	46·7	50·5	[57·4]	52·1	51·9	37·4	42·0	28·1
27	44·0	48·1	38·4	36·6	46·4	53·8	62·0	52·4	[50·9]	37·8	38·1	[31·4]
28	41·5	46·9	36·7	36·4	45·7	[52·8]	62·0	55·2	45·4	44·7	30·4	35·8
29	42·7		[38·3]	39·9	50·8	54·4	57·3	56·0	48·9	40·6	[32·1]	37·2
30	43·4		37·7	41·6	51·9	53·8	60·1	[53·5]	50·3	38·8	28·0	34·4
31	48·0		37·3		[53·7]		58·4	54·0		47·3		39·9

TABLE XLVIII.—Mean Temperature of Evaporation at the Observation Hours for each Month, for each Astronomical Quarter, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
	°	°	°	°	°	°	°	°	°
January	38·6	38·7	39·1	41·3	42·3	41·4	40·5	39·8	39·8
February	39·1	38·5	40·5	42·5	43·2	42·6	41·1	40·4	40·0
March	34·9	35·7	38·7	40·9	40·9	40·4	39·3	37·1	36·2
April	38·0	40·3	42·1	43·2	44·0	44·1	43·2	41·3	40·1
May	44·3	46·7	48·5	49·7	50·4	50·5	49·5	47·9	45·7
June	52·0	55·6	58·7	59·4	60·2	59·6	59·4	58·2	55·5
July	53·8	55·6	56·9	57·9	58·2	58·3	57·5	56·0	54·5
August	53·0	55·4	58·2	59·4	60·1	60·5	59·5	57·4	55·2
September	48·7	51·2	55·2	57·2	58·1	57·9	56·3	53·9	52·1
October	43·2	43·5	46·7	49·0	49·5	48·9	46·7	45·3	44·2
November	40·8	39·9	41·1	43·2	43·7	43·1	42·0	41·8	41·6
December	30·1	30·4	31·6	33·2	34·0	33·3	31·8	31·2	30·7
Nov., Dec., Jan.,	36·50	36·33	37·27	39·23	40·00	39·27	38·10	37·60	37·37
Feb., Mar., Apr.,	37·33	38·17	40·43	42·20	42·70	42·37	41·20	39·60	38·77
May, June, July,	50·03	52·63	54·70	55·67	56·27	56·13	55·47	54·03	51·90
Aug., Sept., Oct.,	48·30	50·03	53·37	55·20	55·90	55·77	54·17	52·20	50·50
The Year	43·04	44·29	46·44	48·07	48·72	48·38	47·23	45·86	44·63

TABLE XLIX.—Daily and Weekly Means of the Pressure of Aqueous Vapour, in inches of Mercury, for the Year 1846, as deduced from Tables XLIII. and XLVII.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·178	[0·264]	[0·297]	0·275	0·326	0·354	0·409	0·528	0·321	0·355	[0·306]	0·202
2	·162	·226	·269	·286	·280	·453	·415	[·512]	·404	·304	·314	·128
3	·228	·283	·313	·225	[·290]	·434	·465	·538	·436	·281	·346	·161
4	[·222]	·214	·271	·195	·258	·441	·453	·492	·480	[·333]	·347	·153
5	·193	·209	·233	[·231]	·321	·414	[·398]	·510	·462	·401	·330	·211
6	·284	·231	·225	·208	·307	·380	·398	·484	[·447]	·350	·316	[·197]
7	·286	·217	·217	·224	·260	[·428]	·304	·530	·491	·308	·300	·192
8	·309	[·203]	[·235]	·249	·264	·448	·353	·575	·446	·318	[·269]	·233
9	·265	·182	·222	·216	·294	·439	·404	[·469]	·369	·374	·237	·235
10	·273	·171	·252	·234	[·282]	·446	·394	·425	·318	·395	·206	·180
11	[·249]	·211	·259	·265	·276	·375	·346	·405	·461	[·318]	·227	·142
12	·213	·219	·278	[·277]	·290	·400	[·424]	·393	·461	·331	·275	·161
13	·198	·220	·256	·329	·309	·427	·496	·454	[·421]	·225	·271	[·158]
14	·235	·221	·250	·313	·285	[·410]	·446	·342	·440	·266	·239	·136
15	·248	[·229]	[·222]	·303	·267	·413	·456	·435	·428	·315	[·269]	·162
16	·199	·256	·232	·313	·254	·410	·458	[·427]	·421	·315	·227	·166
17	·241	·233	·148	·316	[·287]	·437	·402	·450	·410	·375	·303	·150
18	[·241]	·227	·168	·267	·320	·512	·367	·455	·315	[·330]	·299	·158
19	·251	·225	·119	[·267]	·286	·491	[·405]	·424	·369	·357	·283	·269
20	·272	·223	·153	·235	·311	·348	·384	·443	[·358]	·316	·301	[·200]
21	·238	·308	·183	·231	·334	[·420]	·444	·456	·337	·302	·261	·240
22	·286	[·288]	[·187]	·240	·344	·400	·375	·461	·288	·306	[·277]	·192
23	·259	·332	·211	·252	·357	·452	·451	[·408]	·432	·208	·232	·189
24	·247	·345	·237	·281	[·322]	·320	·355	·369	·423	·271	·307	·148
25	[·275]	·297	·222	·286	·348	·332	·373	·351	·406	[·258]	·278	·155
26	·312	·293	·221	[·239]	·267	·352	[·449]	·370	·386	·233	·263	·166
27	·287	·321	·216	·192	·281	·380	·531	·370	[·374]	·239	·231	[·190]
28	·257	·317	·214	·194	·252	[·374]	·520	·416	·316	·293	·176	·219
29	·263		[·223]	·228	·318	·379	·463	·437	·354	·262	[·193]	·237
30	·265		·205	·250	·334	·392	·516	[·391]	·356	·247	·159	·215
31	·334		·209		·357		·486	·397		·319		·261

TABLE L.—Pressure of Aqueous Vapour, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Mean Pressure of Vapour.	Moon's Age.	Mean Pressure of Vapour.	After Moon farthest North.	Mean Pressure of Vapour.	After Moon farthest North.	Mean Pressure of Vapour.
Day.	in.	Day.	in.	Day.	in.	Day.	in.
15	0·333	0	0·316	0	0·311	14	0·314
16	·327	1	·301	1	·313	15	·307
17	·320	2	·292	2	·298	16	·306
18	·319	3	·298	3	·286	17	·313
19	·315	4	·317	4	·283	18	·337
20	·305	5	·312	5	·301	19	·326
21	·313	6	·317	6	·311	20	·313
22	·297	7	·317	7	·325	21	·317
23	·298	8	·313	8	·306	22	·323
24	·301	9	·315	9	·308	23	·329
25	·317	10	·315	10	·307	24	·321
26	·305	11	·313	11	·321	25	·296
27	·323	12	·299	12	·326	26	·302
28	·318	13	·304	13	·318	27	·309
29	·329	14	·315				

TABLE LI.—Mean Pressure of Aqueous Vapour at the Observation Hours for each Month, for each Astronomical Quarter, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	0·238	0·242	0·242	0·259	0·267	0·261	0·252	0·246	0·247
February	·238	·234	·248	·255	·258	·252	·247	·243	·243
March	·210	·215	·228	·234	·225	·220	·221	·217	·215
April	·238	·252	·254	·258	·265	·264	·263	·257	·254
May	·289	·296	·297	·300	·311	·306	·305	·305	·294
June	·381	·414	·421	·402	·407	·412	·418	·431	·419
July	·406	·419	·427	·435	·437	·438	·434	·427	·415
August	·408	·433	·460	·463	·469	·468	·460	·451	·431
September	·350	·378	·418	·427	·438	·436	·419	·405	·389
October	·285	·288	·315	·335	·332	·324	·311	·302	·294
November	·261	·251	·259	·274	·273	·269	·267	·266	·266
December	·176	·179	·186	·191	·196	·192	·186	·183	·181
Nov., Dec., Jan.,	·225	·224	·229	·241	·245	·241	·235	·232	·231
Feb., Mar., Apr.,	·229	·234	·243	·249	·249	·245	·244	·239	·237
May, June, July,	·359	·376	·382	·379	·385	·385	·386	·388	·376
Aug., Sept., Oct.,	·348	·366	·398	·408	·413	·409	·397	·386	·371
The Year	·290	·300	·313	·319	·323	·320	·315	·311	·304

TABLE LII.—Mean Relative Humidity of the Air for each Week-Day and Week in 1846. Saturation being = 1.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0·757	[0·851]	[0·843]	0·899	0·867	0·639	0·838	0·898	0·793	0·872	[0·898]	0·898
2	·831	·807	·784	·851	·670	·715	·742	[·892]	·840	·886	·837	·877
3	·891	·865	·899	·849	[·827]	·661	·863	·835	·850	·829	·889	·899
4	[·854]	·881	·807	·878	·881	·639	·816	·821	·870	[·852]	·883	·895
5	·906	·807	·841	[·862]	·879	·603	[·810]	·892	·872	·859	·930	·865
6	·896	·878	·896	·816	·850	·575	·896	·811	[·854]	·827	·873	[·890]
7	·846	·783	·813	·855	·739	[·711]	·689	·980	·847	·842	·901	·835
8	·883	[·852]	[·849]	·926	·680	·865	·857	·919	·861	·878	[·929]	·943
9	·872	·879	·874	·828	·742	·791	·942	[·861]	·822	·919	·944	·904
10	·850	·929	·797	·815	[·733]	·795	·790	·843	·807	·868	·954	·796
11	[·900]	·834	·872	·908	·710	·737	·744	·830	·838	[·871]	·970	·798
12	·922	·866	·850	[·871]	·699	·746	[·820]	·784	·887	·892	·926	·875
13	·952	·837	·760	·846	·831	·713	·831	·871	[·872]	·753	·903	[·846]
14	·922	·770	·772	·846	·785	[·701]	·795	·769	·911	·914	·885	·855
15	·932	[·815]	[·802]	·981	·740	·705	·816	·916	·882	·946	[·891]	·890
16	·990	·821	·800	·894	·741	·667	·858	[·872]	·905	·963	·857	·865
17	·956	·806	·701	·952	[·777]	·637	·837	·865	·861	·966	·904	·909
18	[·933]	·791	·928	·878	·889	·756	·844	·932	·838	[·931]	·874	·898
19	·916	·801	·875	[·884]	·730	·714	[·832]	·878	·898	·925	·858	·954
20	·898	·820	·879	·822	·777	·795	·798	·927	[·862]	·890	·846	[·923]
21	·905	·895	·893	·895	·859	[·770]	·895	·857	·810	·899	·859	·972
22	·986	[·856]	[·884]	·866	·835	·629	·759	·867	·811	·905	[·895]	·906
23	·970	·885	·883	·860	·867	·940	·871	[·860]	·954	·715	·903	·900
24	·957	·885	·891	·934	[·785]	·786	·743	·839	·953	·903	·933	·902
25	[·919]	·853	·881	·885	·760	·808	·767	·834	·855	[·886]	·972	·866
26	·920	·837	·874	[·818]	·654	·850	[·835]	·839	·932	·943	·871	·933
27	·820	·840	·777	·716	·734	·782	·875	·787	[·929]	·960	·888	[·932]
28	·860	·890	·849	·738	·633	[·809]	·828	·856	·981	·891	·893	·932
29	·832		[·822]	·778	·681	·742	·928	·895	·967	·946	[·883]	·979
30	·805		·743	·814	·692	·836	·957	[·836]	·886	·957	·874	·982
31	·915		·789		[·670]		·951	·845		·879		·985

TABLE LIII.—Mean Relative Humidity of the Air, Saturation being = 1, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Mean Relative Humidity.	Moon's Age.	Mean Relative Humidity.	After Moon farthest North.	Mean Relative Humidity.	After Moon farthest North.	Mean Relative Humidity.
Day.		Day.		Day.		Day.	
15	0·873	0	0·844	0	0·827	14	0·847
16	·847	1	·830	1	·859	15	·856
17	·820	2	·825	2	·845	16	·878
18	·843	3	·814	3	·839	17	·877
19	·854	4	·848	4	·866	18	·866
20	·829	5	·833	5	·850	19	·865
21	·843	6	·863	6	·860	20	·850
22	·840	7	·851	7	·862	21	·835
23	·841	8	·867	8	·823	22	·840
24	·854	9	·870	9	·827	23	·849
25	·867	10	·854	10	·826	24	·842
26	·881	11	·833	11	·838	25	·836
27	·879	12	·847	12	·835	26	·845
28	·862	13	·823	13	·847	27	·838
29	·885	14	·864				

TABLE LIV.—Mean Relative Humidity at the Observation Hours for each Month, for each Astronomical Quarter, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
January	0·905	0·924	0·906	0·887	0·878	0·894	0·890	0·888	0·895
February	·878	·886	·864	·799	·777	·778	·823	·841	·862
March	·917	·911	·835	·760	·710	·707	·765	·848	·885
April	·941	·900	·814	·777	·773	·763	·804	·871	·924
May	·892	·794	·702	·658	·669	·644	·690	·770	·838
June	·901	·818	·664	·565	·544	·588	·616	·730	·848
July	·902	·841	·792	·763	·751	·750	·783	·849	·898
August	·969	·921	·847	·778	·758	·729	·760	·862	·929
September	·959	·940	·865	·774	·763	·768	·798	·890	·935
October	·931	·932	·895	·859	·814	·808	·871	·907	·925
November	·926	·916	·899	·864	·832	·843	·896	·899	·914
December	·912	·923	·912	·872	·863	·873	·903	·910	·919
Nov., Dec., Jan.,	·914	·921	·906	·874	·858	·870	·896	·899	·909
Feb., Mar., Apr.,	·912	·899	·838	·779	·753	·749	·797	·853	·890
May, June July,	·898	·818	·719	·662	·655	·661	·696	·783	·861
Aug., Sept., Oct.,	·953	·931	·869	·804	·778	·768	·810	·886	·930
The Year,	·919	·892	·833	·780	·761	·762	·800	·855	·898

TABLE LV.—Daily and Weekly Means of the Height of the Barometer in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·394	[29·336]	[29·259]	29·046	29·955	29·945	29·490	29·724	30·089	29·608	[29·762]	29·425
2	30·041	29·484	29·397	28·913	29·860	29·962	29·615	[29·783]	30·043	29·486	29·599	29·318
3	29·948	29·296	29·169	29·016	[29·688]	29·978	29·768	29·660	30·036	29·434	29·664	29·422
4	[29·758]	29·493	28·892	29·273	29·705	29·929	29·813	29·722	30·053	[29·275]	29·721	29·735
5	29·808	29·450	29·212	[29·100]	29·369	29·884	[29·557]	29·736	29·961	29·247	29·896	29·498
6	29·606	29·451	29·265	29·060	29·214	29·819	29·119	29·730	[29·847]	28·982	29·911	[29·789]
7	29·754	29·276	29·377	29·125	29·352	[29·711]	29·445	29·596	29·648	28·891	29·997	29·958
8	30·044	[29·730]	[29·681]	29·214	29·563	29·624	29·581	29·424	29·564	28·936	[30·119]	30·121
9	30·245	30·099	29·941	29·401	29·607	29·493	29·553	[29·626]	29·822	29·042	30·273	29·998
10	30·047	30·197	30·053	29·468	[29·621]	29·520	29·670	29·631	30·128	28·934	30·323	29·585
11	[29·769]	29·905	30·239	29·246	29·694	29·801	29·807	29·626	30·194	[29·170]	30·314	29·501
12	29·661	29·896	30·266	[29·424]	29·709	29·909	[29·635]	29·748	30·297	29·436	30·325	29·613
13	29·352	29·859	29·955	29·227	29·803	29·890	29·714	29·313	[30·108]	29·752	30·257	[29·483]
14	29·266	29·925	29·604	29·513	29·954	[29·957]	29·514	29·608	30·057	28·923	30·137	29·335
15	29·413	[29·892]	[29·511]	29·690	29·777	29·977	29·551	29·418	30·007	28·718	[29·908]	29·371
16	29·596	29·978	28·707	29·839	29·475	30·088	29·282	[29·434]	29·963	29·029	29·842	29·491
17	29·540	29·899	29·078	29·727	[29·358]	30·076	28·995	29·492	29·824	29·258	29·497	29·592
18	[29·188]	29·793	29·458	29·844	28·798	29·965	28·911	29·311	29·756	[29·031]	29·389	29·699
19	28·935	29·752	29·438	[29·848]	29·031	29·861	[29·273]	29·463	29·499	29·290	29·283	29·456
20	28·685	29·774	29·479	30·000	29·113	30·064	29·556	29·494	[29·561]	29·190	28·760	[29·187]
21	28·961	29·684	28·990	29·851	29·579	[29·636]	29·423	29·689	29·563	28·702	29·030	28·749
22	28·663	[29·456]	[29·124]	29·825	29·837	29·668	29·474	29·832	29·522	28·779	[29·152]	28·818
23	28·865	29·380	28·823	29·790	29·977	29·205	29·392	[29·867]	29·200	29·298	29·388	28·810
24	29·159	29·105	28·971	29·727	[29·810]	29·055	29·435	30·078	29·195	29·247	29·275	29·183
25	[28·913]	29·041	29·042	29·781	29·834	29·264	29·603	30·104	29·422	[29·504]	29·178	29·621
26	28·763	29·335	29·183	[29·766]	29·833	29·360	[29·641]	30·003	29·315	29 785	28·932	30·036
27	29·015	29·341	29·377	29·664	29·801	29·361	29·715	29·899	[29·304]	30·025	29·244	[29·892]
28	29·012	29·420	29·412	29·733	29·977	[29·356]	29·821	29·917	29·321	29·891	29·364	30·128
29	29·078		[29·381]	29·900	30·034	29·303	29·883	29·884	29·099	29·926	[29·342]	30·134
30	29·383		29·847	30·025	29·982	29·360	29·939	[29·960]	29·470	29·919	29·772	30·252
31	29·285		29·421		[29·980]		29·918	29·929		29·741		30·279

TABLE LVI.—Mean Height of the Barometer at the Observation Hours for each Month, for each Astronomical Quarter, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January	29·364	29·375	29·390	29·397	29·392	29·398	29·406	29·412	29·413
February	·598	·602	·612	·624	·620	·613	·620	·633	·634
March	·405	·410	·411	·416	·409	·402	·399	·404	·406
April	·523	·536	·539	·534	·532	·524	·527	·545	·556
May	·643	·655	·656	·655	·652	·643	·639	·648	·652
June	·716	·721	·717	·712	·702	·695	·685	·692	·707
July	·549	·557	·560	·561	·558	·550	·548	·554	·567
August	·695	·700	·697	·693	·685	·678	·674	·687	·701
September	·735	·744	·747	·738	·727	·714	·713	·726	·734
October	·306	·311	·314	·309	·299	·298	·308	·322	·330
November	·654	·665	·678	·676	·659	·646	·642	·638	·642
December	·577	·581	·599	·604	·595	·598	·604	·614	·620
Nov., Dec., Jan.,	·5317	·5403	·5557	·5590	·5487	·5473	·5507	·5547	·5583
Feb., Mar., Apr.,	·5087	·5160	·5207	·5247	·5203	·5130	·5153	·5273	·5320
May, June, July,	·6360	·6443	·6413	·6427	·6373	·6293	·6240	·6313	·6420
Aug., Sept., Oct.,	·5787	·5850	·5860	·5800	·5703	·5633	·5650	·5783	·5883
The Year	·5637	·5714	·5767	·5766	·5692	·5632	·5637	·5729	·5802

TABLE LVII.—Diurnal Range of the Barometer for each Week-Day and Week, for 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·761	[0·311]	[0·211]	0·202	0·167	0·056	0·116	0·209	0·084	0·113	[0·105]	0·381
2	·433	·187	·252	·143	·089	·023	·272	[·093]	·055	·352	·056	·063
3	·564	·539	·246	·436	[·180]	·068	·101	·081	·032	·181	·147	·219
4	[·364]	·349	·377	·188	·378	·066	·058	·029	·052	[·246]	·104	·251
5	·110	·160	·211	[·192]	·285	·064	[·183]	·025	·125	·330	·183	·437
6	·092	·268	·071	·161	·078	·072	·294	·067	[·146]	·201	·034	[·251]
7	·226	·524	·300	·032	·164	[·089]	·320	·185	·164	·298	·145	·241
8	·388	[·260]	[·217]	·193	·293	·157	·051	·111	·158	·338	[·086]	·088
9	·155	·216	·235	·123	·278	·103	·042	[·107]	·346	·316	·075	·269
10	·127	·178	·099	·051	[·177]	·071	·168	·073	·165	·549	·045	·321
11	[·234]	·214	·388	·365	·091	·411	·082	·111	·058	[·493]	·034	·076
12	·354	·057	·231	[·218]	·062	·067	[·130]	·098	·222	·535	·045	·152
13	·259	·031	·243	·303	·177	·026	·211	·579	[·113]	0·192	·117	[·164]
14	·121	·143	·449	·245	·085	[·137]	·200	·237	·099	1·026	·110	·126
15	·288	[·087]	[·383]	·223	·272	·133	·079	·282	·045	0·258	[·196]	·203
16	·085	·072	·482	·093	·345	·089	·437	[·281]	·092	·279	·394	·105
17	·055	·166	·704	·096	[·241]	·097	·146	·207	·134	·200	·341	·389
18	[·285]	·054	·190	·178	·147	·137	·256	·183	·100	[·258]	·171	·384
19	·693	·070	·022	[·124]	·345	·091	[·246]	·197	·297	·134	·062	·098
20	·390	·067	·068	·162	·251	·198	·125	·079	[·175]	·132	·970	[·242]
21	·200	·099	·730	·147	·496	[·252]	·285	·327	·057	·544	·611	·168
22	·331	[·215]	[·198]	·067	·121	·453	·226	·043	·148	·327	[·418]	·144
23	·109	·233	·163	·138	·145	·500	·273	[·118]	·316	·484	·267	·268
24	·363	·392	·111	·098	[·164]	·134	·150	·073	·149	·213	·192	·346
25	[·257]	·432	·095	·034	·100	·234	·230	·056	·201	[·274]	·407	·537
26	·112	·105	·258	[·112]	·034	·085	[·159]	·129	·263	·320	·198	·335
27	·403	·126	·091	·062	·091	·111	·148	·108	[·258]	·126	·311	[·240]
28	·227	·159	·102	·214	·160	[·133]	·068	·054	·274	·174	·230	·047
29	·322		[·255]	·129	·059	·087	·083	·088	·229	·122	[·250]	·086
30	·195		·322	·081	·048	·164	·086	[·104]	·432	·090	·320	·092
31	·272		·553		[·069]		·131	·234		·111		·041

TABLE LVIII.—Diurnal Range of the Barometer, with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Mean Diurnal Range.	Moon's Age.	Mean Diurnal Range.	After Moon farthest North.	Mean Diurnal Range.	After Moon farthest North.	Mean Diurnal Range.
Day.	in.	Day.	in.	Day.	in.	Day.	in.
15	0·204	0	0·221	0	0·222	14	0·232
16	·167	1	·147	1	·233	15	·222
17	·208	2	·248	2	·251	16	·250
18	·200	3	·248	3	·184	17	·166
19	·192	4	·207	4	·216	18	·208
20	·209	5	·182	5	·171	19	·173
21	·228	6	·191	6	·164	20	·186
22	·255	7	·257	7	·148	21	·182
23	·146	8	·202	8	·132	22	·219
24	·298	9	·190	9	·156	23	·176
25	·179	10	·189	10	·245	24	·249
26	·187	11	·152	11	·244	25	·228
27	·219	12	·181	12	·201	26	·228
28	·212	13	·155	13	·175	27	·215
29	·253	14	·155				

TABLE LIX.—Extreme Readings of the Barometer for each Month; Extreme Mean Daily Heights for each Month; and Extreme Diurnal Ranges for each Month, together with the Ranges and Means of the Extremes, for 1846.

Month.	Extreme Readings.								Extreme Daily Means.						Extreme Diurnal Ranges.			
	Highest.			Lowest.			Range.	Mean.	Highest.		Lowest.		Range.	Mean.	Greatest.		Least.	
	d.	h.	in.	d.	h.	in.	in.	in.	d.	in.	d.	in.	in.	in.	d.	in.	d.	in.
Jan.	9	0	30·304	21	18	28·498	1·806	29·401	9	30·245	22	28·663	1·582	29·454	1	0·761	17	0·055
Feb.	9	23	30·268	24	22	28·863	1·405	29·565	10	30·197	25	29·041	1·156	29·619	3	0·539	13	0·031
March	11	10	30·380	16	8	28·492	1·888	29·436	12	30·266	16	28·707	1·559	29·486	21	0·730	19	0·022
April	29	21	30·058	2	18	28·823	1·235	29·440	30	30·025	2	28·913	1·112	29·469	3	0·436	7	0·032
May	28	18	30·066	18	4	28·772	1·294	29·419	29	30·034	18	28·798	1·236	29·416	21	0·496	26	0·034
June	16	10	30·115	23	18	28·988	1·127	29·551	16	30·088	24	29·055	1·033	29·571	23	0·500	2	0·023
July	30	10	29·986	18	6	28·778	1·208	29·382	30	29·939	18	28·911	1·028	29·425	16	0·437	9	0·042
Aug.	24	20	30·132	13	2	29·118	1·014	29·625	25	30·104	18	29·311	0·793	29·707	13	0·579	5	0·025
Sept.	12	10	30·351	29	4	29·027	1·324	29·689	12	30·297	29	29·099	1·198	29·698	30	0·432	3	0·032
Oct.	27	0	30·061	21	4	28·582	1·479	29·321	27	30·025	21	28·702	1·323	29·363	14	1·026	30	0·090
Nov.	10	0	30·352	20	8	28·267	2·085	29·310	12	30·325	20	28·760	1·565	29·542	20	0·970	6 11	0·034
Dec.	30	22	30·304	22	18	28·681	1·623	29·492	31	30·279	21	28·749	1·530	29·514	25	0·537	28	0·047

TABLE LX.—Daily and Weekly Means of the Pressure of the Wind, in Pounds on the Square Foot of Surface, deduced from the greatest pressures occurring between the Observation Hours, in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	1·97	[1·92]	[1·97]	0·37	0·69	0·15	1·17	0·62	0·30	0·37	[0·80]	1·04
2	0·14	0·49	2·22	0·28	1·52	0·21	0·82	[0·32]	0·50	0·18	1·45	0·12
3	0·36	2·30	2·55	1·98	[0·72]	0·13	1·34	0·16	0·62	0·42	0·87	0·40
4	[0·89]	1·36	4·86	0·22	1·29	0·18	1·03	0·22	0·20	[0·80]	1·26	0·31
5	0·17	1·02	0·35	[0·94]	0·45	0·20	[0·99]	0·11	0·12	0·77	0·36	0·52
6	0·86	1·12	0·21	1·33	0·27	0·47	1·64	0·11	[0·36]	1·33	0·92	[0·43]
7	1·83	4·75	0·70	1·39	1·42	[0·44]	0·78	0·37	0·19	1·74	0·23	1·00
8	2·04	[1·43]	[0·44]	0·42	1·21	0·09	0·32	0·19	0·61	1·10	[0·31]	0·08
9	1·26	1·26	0·11	0·29	0·82	0·27	0·37	[0·62]	0·42	0·95	0·24	0·27
10	1·30	0·12	0·90	0·29	[1·28]	1·42	0·27	1·02	0·47	1·55	0·07	1·88
11	[0·82]	0·30	0·37	0·89	2·10	1·57	0·77	1·63	0·24	[1·55]	0·07	2·36
12	0·12	0·11	1·26	[0·69]	1·31	1·07	[0·44]	0·43	0·21	3·22	0·09	1·74
13	0·03	0·26	2·12	1·36	0·81	0·58	0·43	1·26	[0·21]	1·82	0·02	[1·37]
14	0·17	0·21	2·27	0·36	0·66	[0·66]	0·21	0·41	0·17	0·69	0·07	0·50
15	0·30	[0·18]	[2·21]	0·96	0·55	0·42	0·62	0·36	0·12	0·07	[0·72]	1·00
16	0·02	0·32	5·05	0·39	0·72	0·22	0·72	[0·46]	0·06	0·09	1·85	0·72
17	0·15	0·13	2·13	0·16	[0·89]	0·13	0·51	0·27	0·09	0·31	1·31	0·40
18	[0·54]	0·08	0·41	0·13	0·68	0·26	0·72	0·25	0·15	[0·36]	0·99	1·05
19	0·83	0·09	0·01	[0·31]	1·32	0·58	[0·88]	0·19	0·14	0·74	1·75	0·62
20	1·35	0·05	0·28	0·30	1·43	0·75	1·15	0·22	[0·31]	0·36	3·57	[0·86]
21	0·60	1·30	2·47	0·17	0·30	[0·71]	0·72	0·24	0·27	0·62	1·84	0·18
22	0·13	[1·01]	[0·50]	0·69	0·90	0·56	1·47	0·22	0·52	0·78	[1·31]	0·12
23	0·05	1·02	0·15	1·62	0·24	0·64	1·95	[0·18]	0·70	0·97	0·24	2·77
24	0·06	1·46	0·07	0·94	[1·12]	1·50	1·80	0·18	0·10	0·50	0·27	0·53
25	[0·40]	2·12	0·02	0·31	2·31	0·22	1·30	0·12	0·28	[0·44]	0·17	0·54
26	0·17	1·13	0·01	[0·84]	1·73	0·58	[1·51]	0·10	0·52	0·10	0·59	0·20
27	0·75	0·63	0·31	0·92	1·27	0·36	1·87	0·17	[0·32]	0·05	2·36	[0·30]
28	1·27	0·42	0·59	0·27	0·37	[1·45]	1·84	0·20	0·18	0·22	1·22	0·15
29	1·70		[0·25]	0·96	0·55	3·57	0·29	0·14	0·61	0·06	[0·96]	0·22
30	2·58		0·12	0·12	0·77	2·78	0·43	[0·30]	0·22	0·17	0·46	0·17
31	3·12		0·10		[0·36]		0·37	0·50		1·01		0·11

TABLE LXI.—Daily and Weekly Means of the Pressure of the Wind in Pounds on the Square Foot of Surface, deduced from the greatest pressures observed within 10^m *at* the Hours of Observation in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	1·14	[0·96]	[1·07]	0·18	0·34	0·05	0·67	0·17	0·16	0·21	[0·41]	0·47
2	0·07	0·27	1·35	0·08	0·71	0·09	0·37	[0·15]	0·31	0·11	0·87	0·04
3	0·19	1·17	1·58	1·27	[0·30]	0·03	0·79	0·10	0·43	0·17	0·39	0·27
4	[0·57]	0·74	2·60	0·16	0·48	0·07	0·61	0·13	0·15	[0·40]	0·53	0·13
5	0·07	0·38	0·10	[0·59]	0·16	0·11	[0·53]	0·04	0·07	0·45	0·17	0·24
6	0·60	0·79	0·12	0·76	0·08	0·29	1·01	0·07	[0·22]	0·76	0·38	[0·18]
7	1·34	2·79	0·33	1·00	0·69	[0·30]	0·27	0·27	0·14	0·72	0·09	0·30
8	1·31	[0·79]	[0·20]	0·28	0·58	0·05	0·16	0·07	0·33	0·52	[0·13]	0·04
9	0·72	0·66	0·04	0·07	0·59	0·14	0·23	[0·35]	0·22	0·59	0·12	0·12
10	0·80	0·04	0·58	0·17	[0·72]	1·13	0·11	0·49	0·26	0·85	0·03	1·20
11	[0·50]	0·11	0·03	0·37	1·32	0·77	0·39	0·99	0·13	[0·92]	0·02	1·32
12	0·07	0·07	0·78	[0·34]	0·62	0·48	[0·23]	0·19	0·12	2·41	0·04	0·83
13	0·00	0·12	1·05	0·72	0·50	0·33	0·29	0·57	[0·12]	0·77	0·02	[0·77]
14	0·07	0·11	1·65	0·06	0·47	[0·32]	0·07	0·17	0·12	0·37	0·00	0·30
15	0·13	[0·10]	[1·21]	0·65	0·29	0·22	0·27	0·23	0·05	0·05	[0·31]	0·64
16	0·00	0·18	3·02	0·11	0·51	0·08	0·33	[0·24]	0·02	0·05	0·82	0·34
17	0·04	0·07	0·67	0·00	[0·56]	0·07	0·30	0·18	0·04	0·14	0·47	0·09
18	[0·30]	0·02	0·12	0·07	0·46	0·02	0·55	0·20	0·09	[0·19]	0·50	0·52
19	0·53	0·05	0·00	[0·12]	0·92	0·20	[0·46]	0·11	0·07	0·39	1·38	0·20
20	0·96	0·00	0·12	0·12	0·70	0·37	0·44	0·12	[0·20]	0·21	2·03	[0·42]
21	0·16	0·76	1·18	0·07	0·12	[0·34]	0·31	0·15	0·22	0·32	1·02	0·16
22	0·10	[0·50]	[0·23]	0·37	0·55	0·20	0·82	0·12	0·30	0·67	[0·79]	0·07
23	0·01	0·37	0·06	1·01	0·13	0·37	1·12	[0·10]	0·46	0·57	0·19	1·48
24	0·02	0·71	0·02	0·44	[0·65]	0·90	0·84	0·09	0·07	0·32	0·10	0·17
25	[0·18]	1·09	0·02	0·19	1·43	0·02	0·61	0·04	0·14	[0·29]	0·05	0·35
26	0·08	0·56	0·01	[0·41]	1·06	0·30	[0·79]	0·05	0·21	0·03	0·42	0·06
27	0·56	0·14	0·12	0·22	0·64	0·15	1·26	0·06	[0·17]	0·02	1·32	[0·14]
28	0·31	0·17	0·21	0·13	0·14	[0·68]	0·82	0·11	0·12	0·11	0·35	0·11
29	1·08		[0·10]	0·49	0·17	1·74	0·09	0·06	0·38	0·02	[0·48]	0·07
30	1·22		0·06	0·01	0·35	1·19	0·25	[0·16]	0·08	0·07	0·27	0·07
31	1·29		0·02		[0·14]		0·23	0·24		0·57		0·07

TABLE LXII.—Mean Pressure of Wind with reference to the Moon's Age and Declination, for 1846.

Moon's Age.	Pressure of Wind.	Moon's Age.	Pressure of Wind.	After Moon farthest North.	Pressure of Wind.	After Moon farthest North.	Pressure of Wind.
Day.	lb.	Day.	lb.	Day.	lb.	Day.	lb.
15	0·33	0	0·58	0	0·45	14	0·40
16	0·45	1	0·47	1	0·50	15	0·40
17	0·51	2	0·55	2	0·63	16	0·34
18	0·36	3	0·41	3	0·33	17	0·26
19	0·59	4	0·52	4	0·25	18	0·28
20	0·26	5	0·63	5	0·25	19	0·25
21	0·27	6	0·35	6	0·26	20	0·43
22	0·46	7	0·62	7	0·45	21	0·44
23	0·38	8	0·23	8	0·45	22	0·42
24	0·38	9	0·38	9	0·42	23	0·45
25	0·30	10	0·31	10	0·44	24	0·38
26	0·23	11	0·52	11	0·62	25	0·52
27	0·36	12	0·37	12	0·46	26	0·54
28	0·31	13	0·38	13	0·32	27	0·41
29	0·37	14	0·17				

TABLE LXIII.—Maximum Pressure of the Wind in each Civil Day in 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	3·1	6·1	2·8	0·9	1·7	0·3	1·8	3·0	0·8	0·9	1·8	2·8
2	0·9	1·2	3·2	0·9	2·9	0·6	1·4	0·5	0·9	0·4	2·4	0·4
3	1·5	7·0	3·8	3·8	1·3	0·3	3·0	0·4	1·4	1·0	1·8	0·9
4	3·9	2·8	10·7	1·0	2·2	0·4	2·1	0·5	0·3	2·0	2·7	0·6
5	1·2	1·6	1·0	1·2	0·9	0·4	5·8	0·3	0·2	1·7	0·8	1·4
6	2·3	2·5	0·7	3·3	0·4	1·3	2·3	0·3	1·0	3·8	1·7	1·9
7	4·5	8·2	1·4	2·4	2·7	0·9	1·7	0·9	0·4	2·8	0·4	2·3
8	6·2	3·1	0·6	0·9	2·3	0·3	0·5	0·6	2·1	1·7	0·4	0·2
9	2·4	2·6	0·4	1·4	2·1	0·6	0·7	1·3	1·1	1·8	0·5	0·5
10	2·7	0·5	2·5	0·6	3·9	2·8	0·7	2·8	1·3	3·5	0·1	2·8
11	0·5	1·5	1·6	3·7	4·0	3·0	1·5	2·6	0·5	1·0	0·1	3·5
12	0·2	0·2	3·0	2·9	2·4	2·0	3·1	0·8	0·5	5·2	0·3	4·7
13	0·1	0·8	3·7	2·5	1·8	1·2	0·9	2·2	0·2	5·1	0·1	1·3
14	0·7	0·4	4·1	1·3	0·9	1·9	0·5	0·9	0·3	2·4	0·1	0·7
15	0·6	1·5	4·1	1·4	1·3	0·6	1·1	1·1	0·3	0·1	0·4	2·2
16	0·1	0·8	7·8	0·7	1·5	0·6	2·0	1·6	0·1	0·2	4·6	2·3
17	0·4	0·5	4·2	1·0	1·1	0·3	1·1	0·8	0·2	0·6	2·0	1·5
18	0·5	0·1	0·7	0·3	2·0	1·9	1·8	0·5	0·4	0·3	1·7	3·4
19	2·6	0·2	0·1	0·8	3·1	1·8	2·8	0·5	0·3	1·3	3·3	1·1
20	2·8	0·1	0·9	1·1	3·0	1·1	2·5	0·5	1·1	1·8	5·2	2·3
21	2·5	3·1	6·2	0·6	1·0	1·1	1·8	0·7	1·0	1·8	5·8	0·9
22	0·2	11·0	1·7	1·9	2·4	1·4	2·5	0·7	1·5	1·9	1·7	0·2
23	0·2	1·8	0·5	2·7	0·5	1·8	3·8	1·0	1·7	3·2	0·5	4·4
24	0·3	3·7	0·2	1·8	1·7	2·7	2·7	0·5	0·3	2·8	0·5	1·3
25	3·3	3·8	0·1	0·7	4·2	0·9	2·5	0·3	0·6	3·7	0·5	1·0
26	0·3	2·1	0·1	4·5	3·4	1·6	2·0	0·4	1·5	0·3	1·0	0·4
27	1·5	2·6	1·4	1·8	2·3	1·0	3·0	0·4	1·2	0·1	4·0	0·1
28	2·4	1·1	1·9	1·1	0·7	2·3	3·5	0·4	0·5	0·3	3·3	0·4
29	4·0		1·7	2·6	1·6	7·5	0·3	0·3	2·4	0·2	2·9	0·5
30	4·7		0·6	0·2	2·1	6·0	0·8	1·0	0·4	0·6	1·0	0·3
31	5·4		0·7		0·9		0·9	0·8		2·2		0·3

TABLE LXIV.—Means of the Maximum Pressure of Wind between the Hours of Observation for each Month, for each of the Astronomical Quarters, and for the Year 1846.

Makerstoun Mean Time.	9h—17h.	17h—19h.	19h—21h.	21h—23h.	23h—1h.	1h—3h.	3h—5h.	5h—7h.	7h—9h.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
January	1·37	0·73	0·67	0·94	1·04	0·96	0·80	0·84	1·05
February	1·90	0·73	0·92	1·19	1·13	1·40	1·22	0·82	0·57
March	1·40	0·96	1·28	1·38	1·55	1·49	1·38	0·98	0·73
April	0·76	0·42	0·68	0·85	1·09	1·08	1·05	0·68	0·34
May	0·88	0·56	1·09	1·37	1·45	1·56	1·54	1·04	0·64
June	0·72	0·44	0·70	0·83	1·06	1·26	0·95	0·79	0·57
July	0·95	0·67	0·96	1·21	1·24	1·32	1·13	0·94	0·69
August	0·39	0·33	0·37	0·48	0·57	0·58	0·47	0·35	0·24
September	0·32	0·22	0·24	0·41	0·51	0·51	0·46	0·32	0·20
October	1·05	0·57	0·70	0·95	1·08	0·89	0·81	0·71	0·60
November	1·28	0·62	0·90	1·10	1·09	1·10	0·92	0·96	0·85
December	1·02	0·67	0·53	0·60	0·64	0·71	0·66	0·68	0·69
Nov., Dec., Jan.,	1·22	0·67	0·70	0·88	0·92	0·92	0·79	0·83	0·86
Feb., Mar., Apr.,	1·35	0·70	0·96	1·14	1·26	1·32	1·22	0·83	0·55
May, June, July,	0·85	0·56	0·92	1·14	1·25	1·38	1·21	0·92	0·63
Aug., Sept., Oct.,	0·59	0·37	0·44	0·61	0·72	0·66	0·58	0·46	0·35
The Year	1·00	0·58	0·75	0·94	1·04	1·07	0·95	0·76	0·60

TABLE LXV.—Means of the Maximum Pressure of Wind within 10m at the Hours of Observation for each Month, for each of the Astronomical Quarters, and for the Year 1846.

Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
January	0·48	0·37	0·36	0·51	0·49	0·42	0·47	0·58	0·44
February	0·42	0·37	0·53	0·75	0·57	0·85	0·49	0·22	0·32
March	0·57	0·44	0·93	0·72	0·71	0·95	0·58	0·49	0·40
April	0·19	0·31	0·50	0·55	0·59	0·61	0·41	0·26	0·18
May	0·20	0·44	0·80	0·96	0·97	0·99	0·76	0·42	0·27
June	0·18	0·30	0·46	0·51	0·61	0·52	0·53	0·31	0·28
July	0·29	0·40	0·76	0·68	0·72	0·78	0·53	0·46	0·34
August	0·11	0·16	0·32	0·35	0·25	0·30	0·26	0·16	0·10
September	0·10	0·13	0·20	0·36	0·29	0·29	0·21	0·18	0·10
October	0·34	0·33	0·43	0·59	0·50	0·55	0·43	0·43	0·41
November	0·37	0·40	0·43	0·59	0·59	0·59	0·49	0·56	0·42
December	0·31	0·31	0·46	0·41	0·35	0·47	0·38	0·39	0·31
Nov., Dec., Jan.,	0·39	0·36	0·42	0·50	0·48	0·49	0·45	0·51	0·39
Feb., Mar., Apr.,	0·39	0·37	0·65	0·67	0·62	0·80	0·49	0·32	0·30
May, June, July,	0·22	0·38	0·67	0·72	0·77	0·76	0·61	0·40	0·30
Aug., Sept., Oct.,	0·18	0·21	0·32	0·43	0·35	0·38	0·30	0·26	0·20
The Year	0·30	0·33	0·51	0·58	0·55	0·61	0·46	0·37	0·30

TABLE LXVI.—Number of Times which the Wind blew from each Point of the Compass at the
together with the sums of the Pres-

Wind blowing from	January.		February.		March.		April.		May.		June.	
	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.
		lb.		lb.		lb.		lb.		lb.		lb.
N.	...	...	1	0·7	7	1·8	13	13·7	4	0·9	1	0·1
N by E.	...	...	1	1·6	...	...	8	12·7	...	...	...	...
NNE.	2	0·4	...	...	3	0·9	25	15·7	7	1·7	8	2·9
NE by N.	2	0·4	...	...	2	0·8	9	4·4	3	0·8	2	0·4
NE.	2	0·2	...	...	1	0·3	24	10·9	9	3·0	9	2·5
NE by E.	...	...	...	...	1	0·3	14	5·1	1	0·8	1	0·4
ENE.	2	0·3	...	...	...	...	11	5·2	10	5·5	3	0·3
E by N.	...	...	...	...	1	0·1	2	0·2	1	0·7	2	0·5
E.	3	2·6	...	...	...	...	4	0·6	6	3·6	1	0·1
E by S.	...	...	...	...	...	...	...	...	1	0·1	...	...
ESE.	2	1·6	...	...	...	...	1	0·1	5	2·7	2	1·0
SE by E.	1	0·8	...	...	...	...	2	0·2	2	1·9	1	0·2
SE.	3	0·7	...	...	1	0·1	1	0·2	7	5·2	3	0·9
SE by S.	...	...	...	...	1	0·1	2	0·2	1	0·1	2	0·8
SSE.	2	0·3	1	1·0	3	0·5	6	3·3	5	3·1	7	2·6
S by E.	...	...	2	1·0	2	0·4	1	0·2	6	5·4	1	0·2
S.	13	1·9	9	3·2	16	30·0	6	3·3	13	11·2	5	1·4
S by W.	16	7·2	7	5·8	8	9·1	6	3·6	3	2·9	3	4·3
SSW.	23	14·3	20	13·0	19	16·9	10	3·1	24	19·7	21	18·1
SW by S.	15	14·3	16	15·6	18	25·0	2	0·7	10	9·8	16	16·4
SW.	43	33·6	28	24·0	22	22·9	4	0·6	17	14·6	24	20·6
SW by W.	13	15·8	12	6·2	10	10·6	2	0·2	6	6·0	17	7·0
WSW.	8	7·1	10	3·9	12	7·9	4	0·4	15	9·9	17	8·7
W by S.	1	0·7	4	1·3	4	8·8	4	2·0	4	1·9	2	0·4
W.	1	1·0	13	13·6	5	3·8	5	1·6	14	15·6	7	2·4
W by N.	3	3·0	6	4·5	6	3·2	1	1·2	4	3·1	4	1·5
WNW.	1	0·9	9	5·1	4	4·9	...	...	13	13·9	2	1·2
NW by W.	2	1·8	1	0·2	...	...	1	0·3	3	0·5	...	...
NW.	1	2·6	9	3·2	4	1·2	3	0·7	3	2·7	3	0·8
NW by N.	...	...	1	0·1	...	...	2	1·6	3	2·1	...	...
NNW.	1	0·2	3	1·5	3	0·7	4	1·4	4	1·2	2	0·2
N by W.	...	...	1	3·3	...	...	...	...	2	0·3	2	0·4

Observation Hours, with a Pressure of one-tenth of a pound or upwards on a square foot of surface, sures, for each Month in 1846.

July.		August.		September.		October.		November.		December.		Wind blowing from
Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	
	lb.		lb.		lb.		lb.		lb.		lb.	
4	1·9	3	0·4	6	0·9	6	8·8	10	10·2	12	14·2	N.
...	...	4	1·2	2	0·5	2	0·4	...	...	1	2·7	N by E.
5	1·6	9	2·1	5	0·5	14	18·5	4	0·7	7	6·6	NNE.
3	0·7	8	1·3	6	0·8	5	3·6	...	...	...	...	NE by N.
19	4·1	22	3·9	16	3·5	5	0·5	3	0·3	...	...	NE.
4	0·8	5	1·2	1	1·0	...	...	...	...	1	0·1	NE by E.
8	2·3	11	2·1	13	4·4	3	0·4	2	0·2	1	0·1	ENE.
2	0·6	2	0·5	...	...	2	0·3	...	...	...	...	E by N.
2	0·3	11	2·1	9	1·2	3	0·3	2	0·2	...	...	E.
...	...	...	...	...	...	...	...	...	...	...	...	E by S.
1	0·2	2	0·4	4	2·0	4	1·6	2	0·2	...	...	ESE.
...	...	2	0·2	...	...	1	0·3	1	0·1	...	...	SE by E.
1	0·2	8	1·2	7	2·4	4	1·4	3	0·9	...	...	SE.
...	...	...	...	...	...	3	1·2	1	2·0	...	...	SE by S.
2	0·2	2	0·2	4	0·9	8	7·4	13	14·2	1	0·2	SSE.
3	2·9	2	0·4	1	0·1	...	...	4	7·0	3	0·3	S by E.
9	6·7	7	4·5	6	1·1	12	3·1	36	25·5	4	0·4	S.
6	8·8	7	1·5	6	1·6	4	1·5	4	1·3	1	0·2	S by W.
30	21·1	21	5·0	16	4·0	44	25·9	30	20·7	13	2·4	SSW.
12	9·7	6	3·0	5	1·0	5	2·4	5	3·6	3	1·7	SW by S.
42	28·6	23	10·6	32	11·0	23	11·7	16	9·3	24	9·7	SW.
17	11·4	6	3·0	7	1·8	2	0·3	3	2·4	5	1·2	SW by W.
19	15·2	12	3·5	11	2·7	15	4·3	5	1·2	17	2·7	WSW.
6	4·4	1	0·3	2	0·8	2	0·3	1	0·1	3	0·8	W by S.
8	4·0	2	0·3	6	1·0	8	1·3	1	0·1	11	2·4	W.
1	0·9	1	0·1	1	0·1	1	0·6	1	0·1	2	0·4	W by N.
6	2·1	1	0·4	2	0·6	4	1·0	3	0·7	5	0·7	WNW.
2	0·5	...	...	1	1·1	3	1·0	...	...	10	5·5	NW by W.
5	1·4	3	0·5	8	1·4	3	2·4	7	2·8	36	15·0	NW.
...	...	1	0·2	...	...	3	2·9	3	1·4	12	9·2	NW by N.
1	1·0	5	2·2	4	1·8	2	1·1	7	3·5	13	11·2	NNW.
2	2·3	1	0·1	3	0·4	6	3·5	3	2·1	6	3·4	N by W.

TABLE LXVII.—Number of Times which the Wind blew from each Point of the Compass
the square foot of surface, together

Wind blowing from	17h.		19h.		21h.		23h.		1h.		3h.	
	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.
		lb.		lb.		lb.		lb.		lb.		lb.
N.	5	3·8	9	8·3	4	5·5	9	4·0	10	7·8	8	9·3
N by E.	1	1·0	...	...	3	5·0	4	5·8	...	...	4	4·7
NNE.	5	2·4	6	3·3	5	4·1	12	9·1	8	5·2	13	8·3
NE by N.	4	2·0	10	3·0	2	1·5	2	0·3	5	2·5	3	1·1
NE.	6	1·2	5	1·9	15	4·5	11	4·7	16	3·6	18	6·7
NE by E.	1	0·1	...	...	3	1·5	2	0·7	8	2·4	4	2·1
ENE.	3	1·2	4	1·8	6	0·6	9	3·6	11	3·9	8	3·7
E by N.	...	...	...	...	4	1·4	2	0·3	...	...	3	0·7
E.	...	...	1	0·1	2	0·2	9	1·9	10	2·1	5	2·5
E by S.	...	...	1	0·1	...	...	...	...	...	...	...	...
ESE.	...	...	...	...	2	1·7	4	2·3	5	2·8	6	2·2
SE by E.	1	0·3	1	0·8	2	0·3	...	...	1	0·1	1	0·1
SE.	5	1·4	3	1·1	1	0·1	4	2·1	5	2·0	8	3·3
SE by S.	1	0·4	1	0·3	2	0·2	3	1·3	...	...	2	2·1
SSE.	6	1·3	3	1·3	9	5·3	6	7·1	6	7·8	7	3·5
S by E.	1	0·6	2	0·2	6	5·2	2	3·0	...	...	1	0·4
S.	12	7·3	16	11·1	16	23·3	18	12·4	22	11·6	13	7·8
S by W.	9	4·8	12	6·0	7	9·0	8	6·1	12	7·2	5	3·0
SSW.	26	11·0	30	12·2	27	17·1	35	33·5	27	20·1	33	20·4
SW by S.	10	9·9	8	6·3	10	5·5	14	13·7	19	18·9	16	19·9
SW.	30	19·5	32	16·3	32	18·6	30	23·7	33	23·3	38	38·9
SW by W.	7	4·1	10	4·2	14	8·9	12	7·9	15	14·4	10	2·5
WSW.	13	3·2	11	3·7	21	12·1	22	11·6	16	9·6	16	9·3
W by S.	3	1·0	5	1·4	4	3·6	...	...	6	3·0	7	9·5
W.	6	3·9	7	8·5	8	3·9	11	5·0	12	8·8	16	10·5
W by N.	1	1·2	2	0·7	4	4·4	2	1·5	6	3·4	6	3·1
WNW.	6	1·2	4	1·4	5	3·1	8	7·5	4	3·5	6	4·8
NW by W.	2	0·3	2	1·4	4	4·4	6	1·6	3	0·9	3	0·8
NW.	7	3·0	5	1·4	10	3·9	12	4·2	12	2·8	11	3·0
NW by N.	3	1·8	3	1·6	3	1·4	3	1·7	2	1·4	3	3·6
NNW.	4	2·5	6	2·3	3	2·1	4	0·7	10	2·7	6	2·0
N by W.	4	2·4	4	3·0	5	2·2	5	4·2	3	1·4	3	0·4

at each Observation Hour in 1846, with a Pressure of one-tenth of a pound or upwards on with the sums of the Pressures.

5h.		7h.		9h.		9 Observations.		12 Observations.		Mean Pressure, Wind Blowing.	Wind blowing from
Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.	Times.	Press.		
	lb.		lb.		lb.		lb.		lb.	lb.	
10	4·9	6	1·9	6	8·0	67	53·5	83	71·2	0·86	N.
2	0·9	2	0·9	2	0·8	18	19·1	22	21·8	0·99	N by E.
12	7·2	11	7·6	17	4·4	89	51·6	122	61·8	0·51	NNE.
6	1·4	4	0·7	4	0·7	40	13·2	52	17·2	0·33	NE by N.
13	2·5	13	2·5	13	1·6	110	29·2	138	33·4	0·24	NE.
3	1·3	5	1·0	2	0·3	28	9·4	32	10·0	0·31	NE by E.
10	3·3	10	1·9	3	0·8	64	20·8	73	23·8	0·33	ENE.
1	0·1	2	0·4	...	...	12	2·9	12	2·9	0·24	E by N.
5	2·3	3	1·1	6	0·6	41	10·8	51	11·7	0·23	E.
...	...	...	...	...	...	1	0·1	1	0·1	0·10	E by S.
4	0·6	1	0·1	1	0·1	23	9·8	24	9·9	0·41	ESE.
2	1·1	2	1·0	...	...	10	3·7	11	4·1	0·37	SE by E.
6	1·3	2	0·5	3	1·3	37	13·1	49	17·1	0·35	SE.
...	...	...	...	1	0·1	10	4·4	13	5·1	0·39	SE by S.
6	3·3	6	2·6	5	1·7	54	33·9	70	38·4	0·55	SSE.
7	5·8	4	1·5	2	1·2	25	17·9	29	20·6	0·71	S by E.
18	9·6	15	7·6	6	1·6	136	92·3	163	105·6	0·65	S.
6	3·2	7	3·8	5	4·7	71	47·8	92	62·0	0·67	S by W.
33	16·2	28	17·9	32	16·1	271	164·5	358	205·1	0·57	SSW.
9	12·5	15	8·9	12	7·6	113	103·2	146	129·4	0·89	SW by S.
35	23·7	41	19·4	27	13·8	298	197·2	383	247·1	0·65	SW.
15	11·7	9	6·2	9	6·1	101	66·0	125	81·3	0·65	SW by W.
13	4·8	20	8·3	13	4·9	145	67·5	184	79·6	0·43	WSW.
1	0·1	5	1·0	3	2·2	34	21·8	43	26·6	0·62	W by S.
9	4·0	4	0·8	8	1·7	81	47·1	102	55·5	0·54	W.
5	3·3	3	0·4	2	0·7	31	18·7	35	21·5	0·61	W by N.
8	4·9	4	1·2	5	3·9	50	31·5	66	39·1	0·59	WNW.
1	1·1	2	0·4	...	...	23	10·9	26	11·3	0·43	NW by W.
14	6·9	8	6·5	6	3·0	85	34·7	104	43·7	0·42	NW.
2	1·5	5	4·3	1	0·2	25	17·5	31	20·5	0·66	NW by N.
5	3·9	6	4·8	5	4·9	49	25·9	62	37·0	0·60	NNW.
2	0·7	2	1·3	1	0·2	29	15·8	36	19·7	0·55	N by W.

TABLE LXVIII.—Sums of the Pressures of the Wind in Table LXVI., resolved into the Four Cardinal Points of the Compass, together with the Value and Direction of the Resultant for each Month, for each of the Astronomical Quarters, and for the Year 1846.

Period 1846.	Sums of Pressures resolved in				Resultant.			
	N.	E.	S.	W.	Sums.	Means with reference to Whole No. of Obs.	Means with reference to No. of Obs., Wind blowing.	Directions.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	°
January	4·8	6·2	71·3	67·2	90·2	0·37	0·56	S. 43 W.
February	12·3	0·9	58·0	68·4	81·5	0·38	0·52	W. 34 S.
March	7·6	1·7	103·2	75·6	120·8	0·52	0·79	S. 38 W.
April	60·4	30·2	15·0	10·1	49·6	0·21	0·28	N. 24 E.
May	19·1	23·6	72·2	75·3	74·1	0·32	0·36	S. 44 W.
June	7·3	7·4	62·2	51·4	70·4	0·30	0·42	S. 39 W.
July	13·8	8·6	79·3	72·2	91·3	0·38	0·41	S. 44 W.
August	11·9	11·6	25·4	19·5	15·6	0·07	0·08	S. 30 W.
September	11·3	13·1	20·6	19·4	11·2	0·05	0·06	S. 34 W.
October	39·6	16·9	50·3	32·3	18·7	0·08	0·10	W. 35 S.
November	19·9	9·1	79·8	25·3	62·0	0·28	0·36	S. 15 W.
December	58·3	3·4	13·4	41·6	58·9	0·24	0·31	N. 40 W.
Astron. Qrs.								
Winter	83·0	18·7	164·5	134·1	141·3	0·20	0·27	W. 35 S.
Spring	80·3	32·8	176·2	154·1	154·6	0·23	0·32	W. 38 S.
Summer	40·2	39·6	213·7	198·9	235·5	0·33	0·40	S. 43 W.
Autumn	62·8	41·6	96·3	71·2	44·7	0·06	0·08	S. 41 W.
The Year.	266·3	132·7	650·7	558·3	573·5	0·20	0·26	W. 42 S.

TABLE LXIX.—Sums of the Pressures of the Wind in Table LXVII., resolved into the Four Cardinal Points of the Compass, together with the Value and Direction of the Resultant, for each of the Observation Hours, and for the Year 1846.

Makerstoun Mean Time.	Sums of Pressures resolved in				Resultant.			
	N.	E.	S.	W.	Sums.	Means with reference to Whole No. of Obs.	Means with reference to No. of Obs., Wind blowing.	Directions.
h.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	°
17	19·3	6·2	51·2	42·8	48·6	0·16	0·27	W. 41 S.
19	24·5	8·4	51·8	44·3	45·1	0·14	0·22	W. 37 S.
21	32·5	15·0	87·1	66·3	74·9	0·24	0·31	W. 47 S.
23	36·7	21·8	99·4	75·4	82·5	0·26	0·31	W. 49 S.
1	29·6	20·7	91·6	80·0	85·9	0·27	0·30	W. 46 S.
3	40·0	24·7	88·9	90·6	82·1	0·26	0·29	W. 37 S.
5	31·0	16·9	73·6	64·7	64·0	0·20	0·24	W. 42 S.
7	28·3	12·0	60·6	51·7	51·2	0·16	0·21	W. 39 S.
9	23·7	6·9	46·7	43·0	42·8	0·14	0·21	W. 32 S.
Sum of 9 Obs.	265·6	132·6	650·9	558·8	574·5	0·20	0·26	W. 42 S.
Sum of 12 Obs.	330·1	152·2	797·8	687·5	710·8	0·19	0·26	W. 41 S.

TABLE LXX.—Differences of the Directions of Motions of the Lower and Upper Currents of Air, as deduced from the Comparisons of the Direction of the Wind and the Motions of the Clouds in 1846.

Currents.	Quadrant N. to E.			Quadrant E. to S.			Quadrant S. to W.			Quadrant W. to N.		
	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.	No. of Results.	Mean Diffs. of Motion.	Mean Result.
		°	°		°	°		°	°		°	°
Scud *minus* Wind	40	+23		17	+20		129	+22		21	+25	
	7	− 7	+18	4	− 9	+12	11	− 9	+19	8	−11	+15
	1	0		4	0		6	0		1	0	
Cir.-str. *minus* Wind	5	+34		7	+17		53	+33		12	+30	
	1	−67	+17	2	−13	+11	6	−14	+29	4	−38	+13
	0	0		0	0		0	0		0	0	
Cir.-str. *minus* Scud	5	+34		9	+28		17	+23		12	+36	
	3	−48	+ 2	0	...	+18	10	−18	+ 6	8	−27	+ 8
	4	0		5	0		8	0		6	0	
Cirrus *minus* Wind	2	+45		2	+58		36	+40		8	+35	
	0	...	+45	0	...	+58	3	−21	+32	1	−22	+26
	0	0		0	0		4	0		1	0	
Cirrus *minus* Scud	3	+26		6	+52		18	+39		12	+30	
	0	...	+20	0	...	+44	6	−12	+23	7	−25	+ 9
	1	0		1	0		3	0		1	0	

TABLE LXXI.—Daily and Weekly Means of the Estimated Extent of Clouded Sky, the whole Sky covered being 10, for 1846.

Civil Day.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1·2	[7·9]	[8·1]	9·1	10·0	0·4	9·2	7·0	4·9	6·2	[6·5]	4·9
2	4·1	6·1	7·9	8·4	9·1	2·2	8·9	[7·9]	7·1	5·2	9·5	1·2
3	9·8	8·1	10·0	7·2	[9·6]	1·4	9·9	6·2	7·9	1·3	6·6	5·0
4	[6·6]	6·3	7·4	9·9	10·0	1·5	5·9	7·7	9·3	[5·4]	5·4	2·4
5	5·1	6·8	2·7	[9·0]	9·2	5·7	[8·8]	7·9	7·0	8·7	7·9	8·2
6	9·9	7·2	8·9	8·8	9·7	5·3	9·8	2·9	[6·9]	5·8	9·5	[6·3]
7	9·5	5·6	4·6	9·5	6·3	[6·9]	8·1	10·0	4·2	5·3	8·6	6·5
8	8·5	[6·7]	[6·2]	10·0	4·3	9·9	10·0	8·8	6·9	6·0	[7·5]	9·7
9	9·1	5·7	6·2	2·9	5·4	8·8	10·0	[7·3]	6·3	6·9	8·4	5·8
10	9·3	7·9	9·2	6·1	[6·3]	10·0	7·1	4·7	2·2	8·4	3·8	4·2
11	[9·0]	7·1	5·7	10·0	4·2	8·2	8·8	8·6	6·6	[8·1]	6·9	7·0
12	9·2	5·4	8·4	[7·6]	8·7	5·8	[8·5]	8·6	9·2	10·0	10·0	6·4
13	8·4	2·5	8·5	9·3	8·9	7·2	7·0	9·1	[6·0]	7·4	10·0	[5·0]
14	9·8	9·7	8·3	7·5	4·5	[4·7]	9·3	5·6	3·8	9·9	10·0	1·5
15	5·7	[7·6]	[7·9]	10·0	6·1	4·7	8·7	7·4	5·6	8·4	[8·1]	5·5
16	9·7	9·4	8·5	7·8	4·7	1·3	10·0	[7·8]	8·7	8·7	4·1	5·6
17	9·4	9·2	5·3	10·0	[6·6]	1·1	9·4	9·4	10·0	9·5	9·2	2·7
18	[8·3]	9·7	8·6	10·0	9·5	4·7	9·3	8·9	5·3	[8·9]	5·1	6·7
19	10·0	10·0	3·1	[7·9]	8·5	8·1	[9·0]	6·6	10·0	7·8	4·2	7·3
20	10·0	10·0	3·6	4·8	6·3	8·1	7·8	9·9	[7·7]	8·9	9·7	[7·2]
21	5·3	9·5	7·7	7·6	4·2	[7·7]	9·9	8·9	6·7	9·9	4·5	9·6
22	10·0	[9·5]	[6·0]	7·2	9·5	6·7	7·5	6·4	6·0	9·1	[6·6]	9·0
23	7·3	9·7	7·5	9·2	9·2	10·0	9·9	[6·4]	8·1	6·5	6·1	8·2
24	6·6	9·6	8·4	10·0	[7·4]	8·4	5·9	5·8	9·6	9·9	5·7	4·5
25	[7·8]	8·4	5·6	9·4	6·1	5·8	5·2	3·5	8·1	[7·1]	9·7	2·8
26	9·7	9·2	7·1	[8·2]	6·2	9·6	[8·3]	3·8	9·0	2·5	10·0	1·0
27	5·8	7·3	7·8	8·4	9·0	5·8	9·1	6·2	[8·9]	5·9	7·7	[4·8]
28	7·5	6·8	6·1	6·2	3·5	[7·5]	9·7	4·2	7·5	8·8	3·6	8·0
29	7·3		[7·7]	5·9	5·7	6·1	10·0	7·8	10·0	4·7	[5·8]	6·9
30	9·5		8·1	9·9	3·2	8·7	9·3	[6·3]	9·0	3·7	7·4	5·5
31	10·0		8·1		[2·7]		9·6	7·5		9·3		9·5

TABLE LXXII.—Means of the Estimated Extent of Clouded Sky at the Observation Hours for each Month, for each of the Astronomical Quarters, and for the Year 1846.

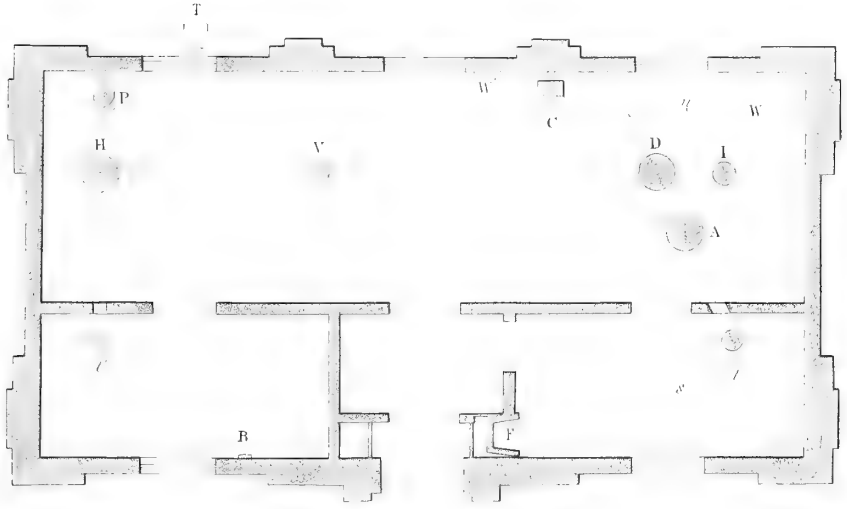
Makerstoun Mean Time.	17h.	19h.	21h.	23h.	1h.	3h.	5h.	7h.	9h.
January	7·7	8·6	8·1	8·5	8·4	8·1	8·5	8·1	7·7
February	6·9	7·3	8·7	8·1	8·1	8·8	8·2	8·2	7·8
March	7·8	7·4	7·8	7·5	7·1	7·3	5·9	5·9	6·1
April	8·5	8·2	8·3	9·4	9·2	8·4	7·8	7·8	7·4
May	6·6	7·7	6·8	7·1	7·3	7·5	6·6	7·7	6·6
June	5·1	5·3	5·5	6·3	6·9	6·8	7·0	6·1	6·2
July	8·8	9·2	9·1	8·6	8·9	8·6	8·3	8·3	8·3
August	7·9	7·9	7·2	7·8	8·0	6·7	6·0	5·7	6·0
September	7·4	7·3	7·8	8·0	7·7	7·7	7·2	7·1	6·1
October	7·1	7·6	8·2	8·3	7·9	6·8	7·6	6·1	6·4
November	7·2	7·0	6·3	7·8	7·7	8·1	7·6	6·9	7·6
December	5·5	7·1	6·4	6·0	6·2	6·5	5·4	4·6	5·0
Nov., Dec., Jan.,	6·8	7·6	6·9	7·4	7·4	7·6	7·2	6·5	6·8
Feb., Mar., Apr.,	7·7	7·6	8·3	8·3	8·1	8·2	7·3	7·3	7·1
May, June, July,	6·8	7·4	7·1	7·3	7·7	7·6	7·3	7·4	7·0
Aug., Sept., Oct.,	7·5	7·6	7·7	8·0	7·9	7·1	6·9	6·3	6·2
The Year,	7·21	7·55	7·52	7·78	7·78	7·61	7·17	6·87	6·77

TABLE LXXIII.—Quantity of Rain by the Observatory, Garden, and Greenhouse Gauges, for the Years 1846–1849.

Month.	Observatory Gauge.				Garden Gauge.			Greenhouse Gauge.			
	1846.	1847.	1848.	1849.	1846.	1847.	1848.	1846.	1847.	1848.	1849.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.	1·901	0·624	1·166	2·775	1·95	0·70	0·95	1·59	0·67	0·85	2·00
Feb.	1·827	0·484	3·780	1·305	1·57	0·52	3·68	1·14	0·44	3·18	0·70
March	2·293	0·330	3·350	0·929	2·17	0·44	3·29	1·61	0·29	2·79	0·78
April	2·272	1·201	1·028	2·480	1·92	1·16	1·05	1·68	0·81	0·80	1·74
May	2·975	4·335	0·350	2·831	2·82	4·16	0·53	2·45	3·46	0·46	2·46
June	2·761	1·970	3·826	2·379	2·55	1·86	3·67	2·26	1·67	3·35	2·07
July	7·124	2·099	1·294	2·383	5·31	3·27	1·40	5·43	3·09	0·95	1·98
Aug.	4·738	1·035	3·223	2·547	4·69	1·08	2·60	4·34	0·87	2·32	2·12
Sept.	4·586	1·375	1·182	1·973	4·37	1·24	1·42	4·14	1·01	1·14	1·57
Oct.	3·506	2·778	4·152	2·417	3·27	2·31	3·72	2·92	2·10	3·30	2·15
Nov.	2·054	1·839	2·252	1·309	1·88	1·71	Gauge	1·24	1·38	1·80	0·95
Dec.	1·817	4·006	1·627	2·000	1·95	3·21	broken.	1·15	2·95	1·20	1·46
Sums	37·854	22·076	27·230	25·328	34·45	21·66		29·95	18·74	22·14	19·98

NOTE.—The Tables in the preceding pages have been formed in the manner already described in the volume for 1844.

MAKERSTOUN MAGNETIC OBSERVATORY.



Term-Day Magnetical Observations. January 22,23:1845.

Göttingen Observations.

Göttingen Mean Time

Declination

Horizontal Component

Vertical Component

Ascending Curves indicate decreasing westerly declination and increasing force

Term-Day Magnetical Observations. February 21, 22. 1845.

Plate. III.

Göttingen Mean Time

Declination

Horizontal Component.

Vertical Component.

Ascending Curves indicate decreasing westerly declination and increasing force.

Term-Day Magnetical Observations. April 23, 24. 1845.

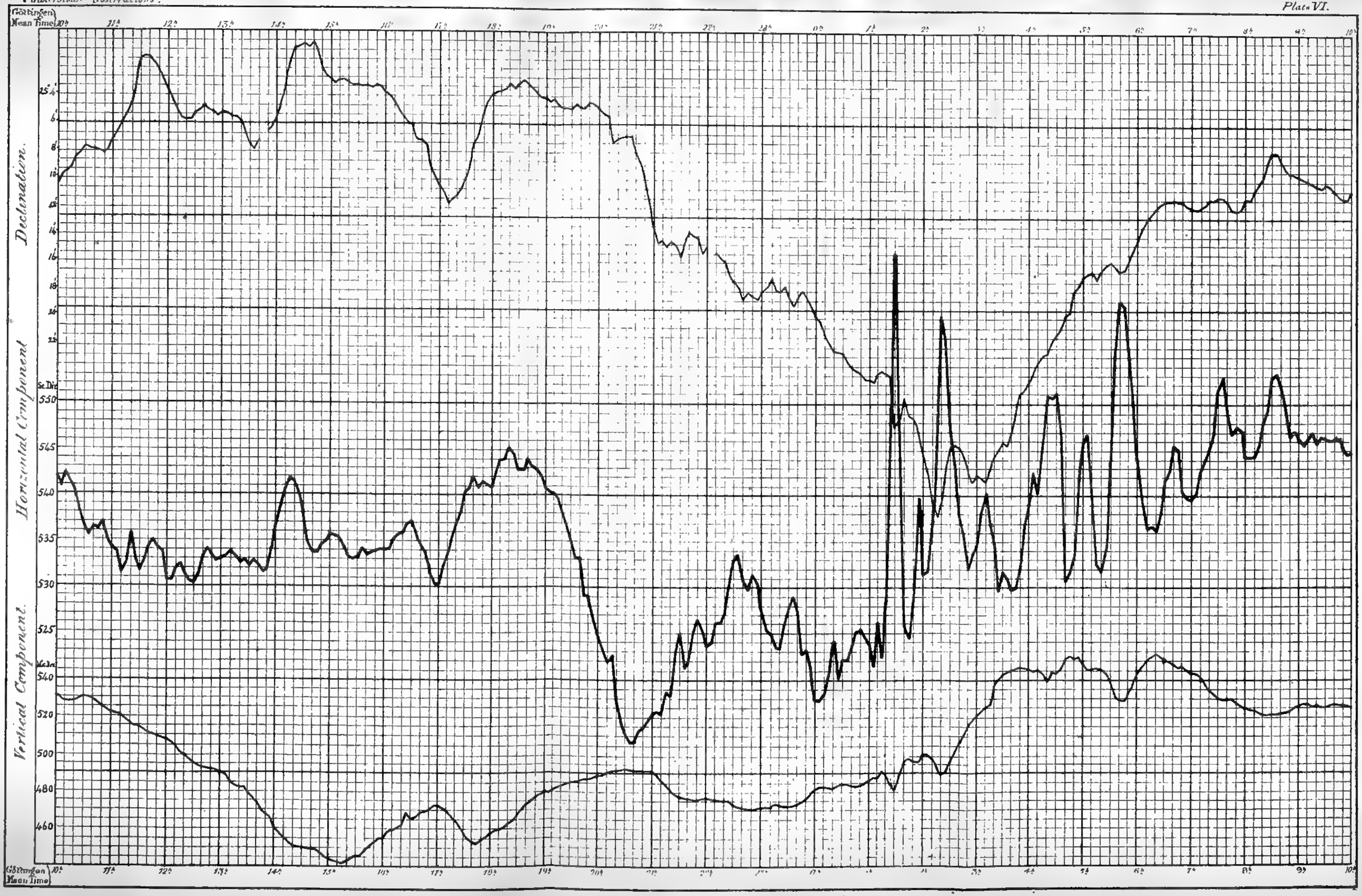
Plate V.

Ascending Curves indicate decreasing westerly declination and increasing force.

Term-Day Magnetical Observations. May 30,31: 1845.

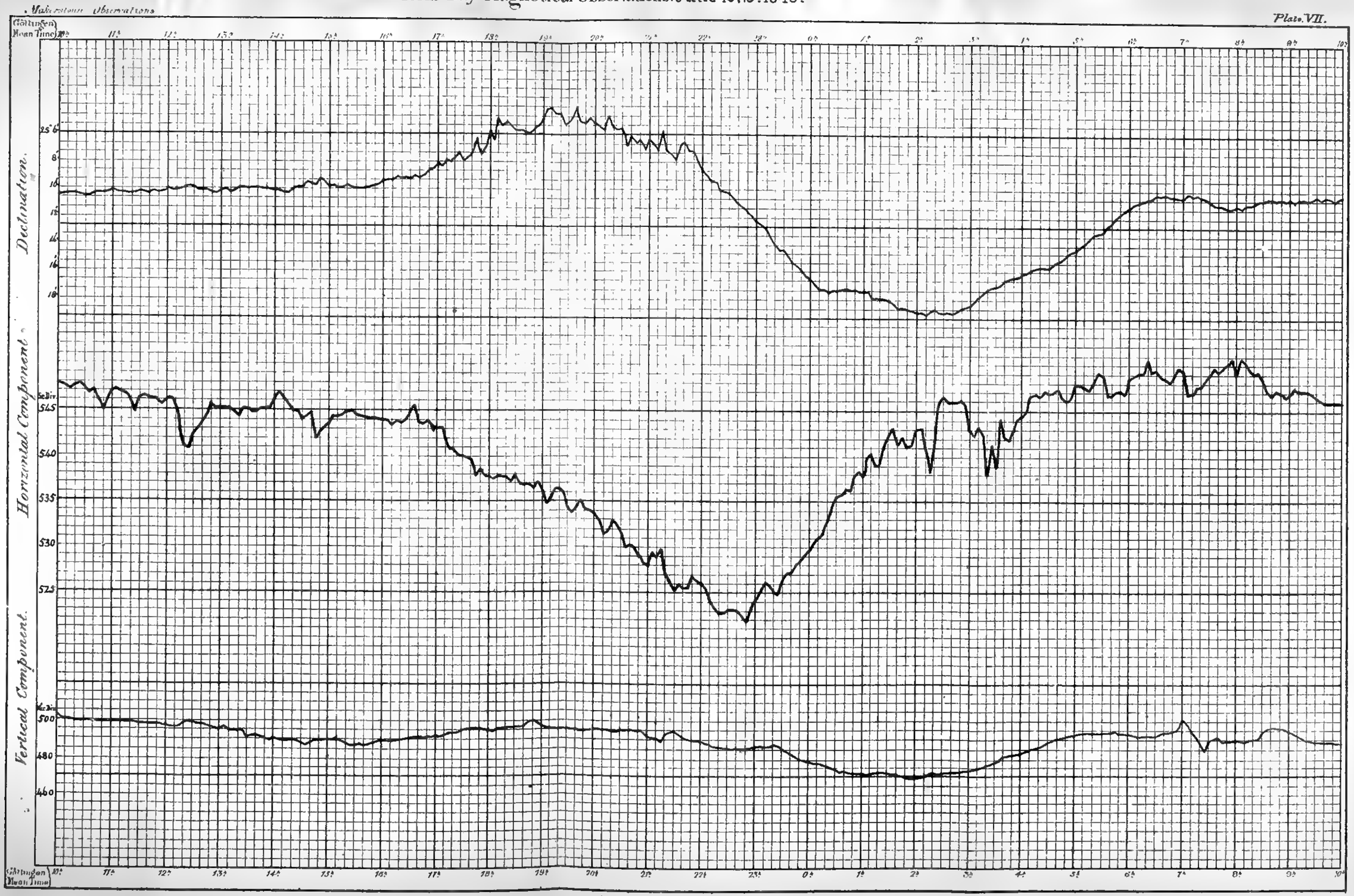
Plate VI.

Ukkerstour Observations.



Ascending Curves indicate decreasing westerly declination and increasing force.

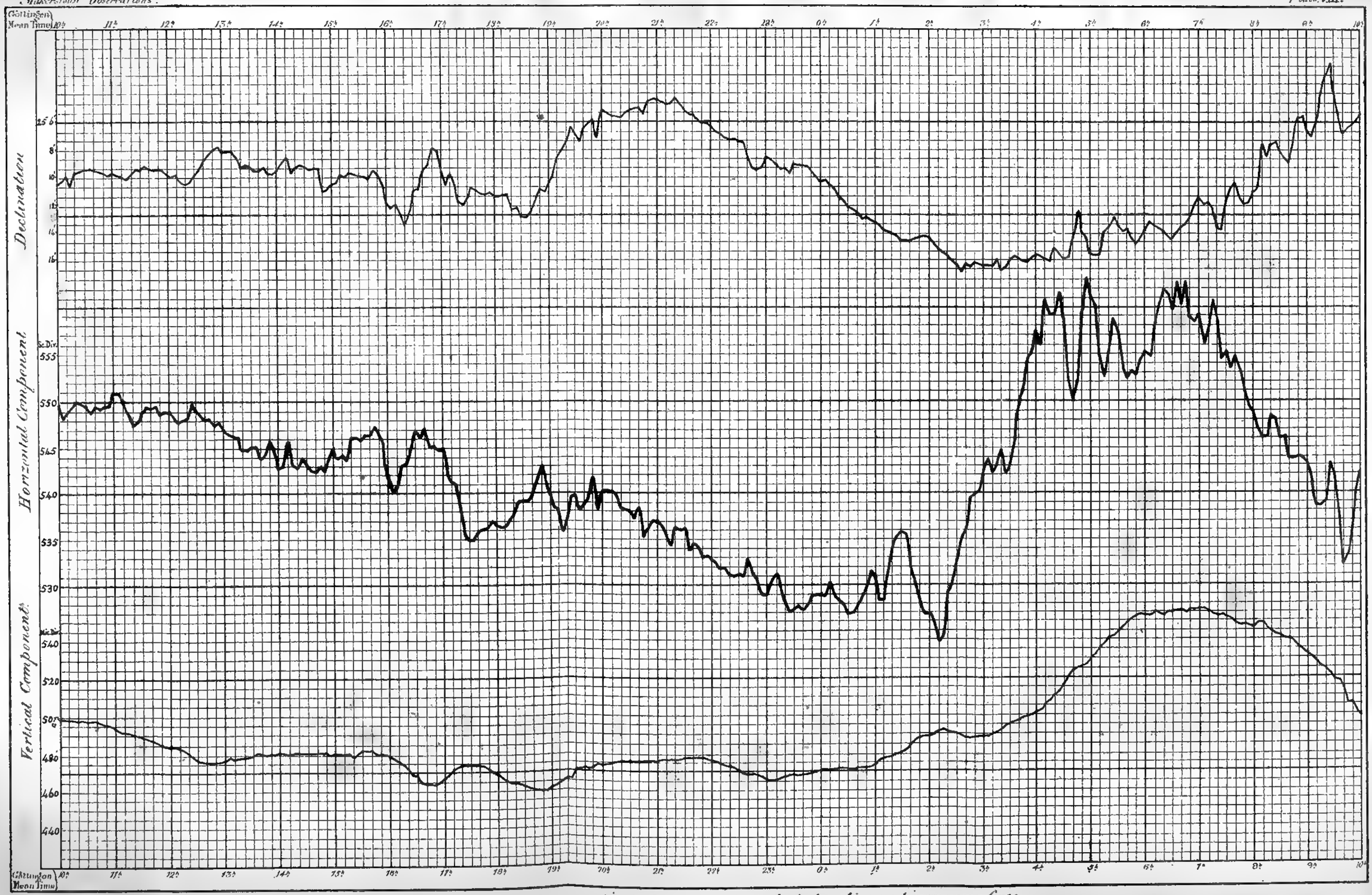
Term-Day Magnetical Observations. June 18, 19: 1845.



Ascending Curves indicate decreasing westerly declination and increasing force.

Term-Day Magnetical Observations. July 23, 24. 1845.

Makerstoun Observations. *Plate VIII.*

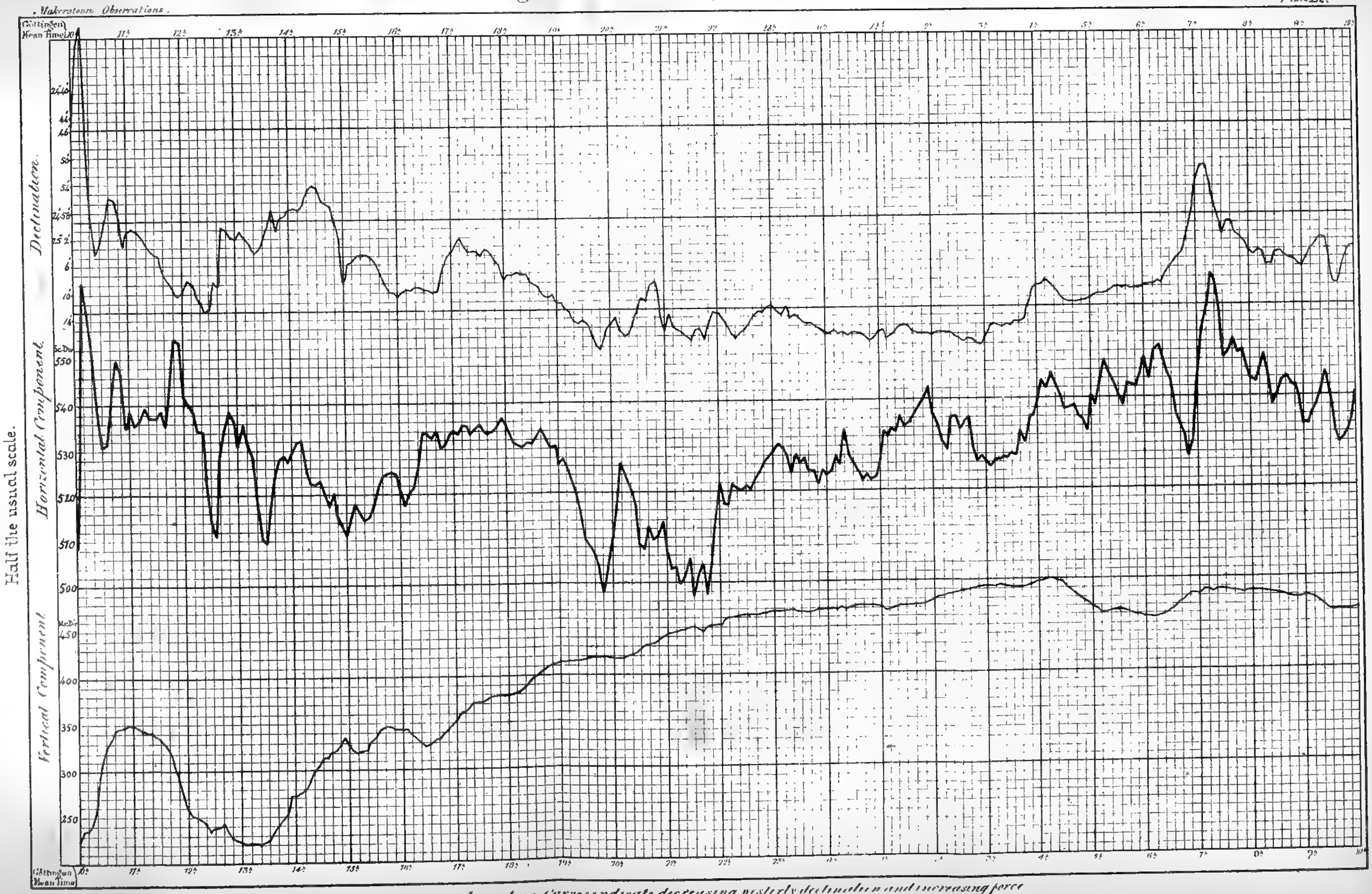


Ascending Curves indicate decreasing westerly declenation and increasing force.

Term-Day Magnetical Observations. August 29, 30. 1845.

Plate IX.

. Makerstoun Observations .



. Ascending Curves indicate decreasing westerly declination and increasing force

Term-Day Magnetical Observations. September 24, 25, 1845.

Plate X.

Half the usual scale.

Declination

Horizontal Component

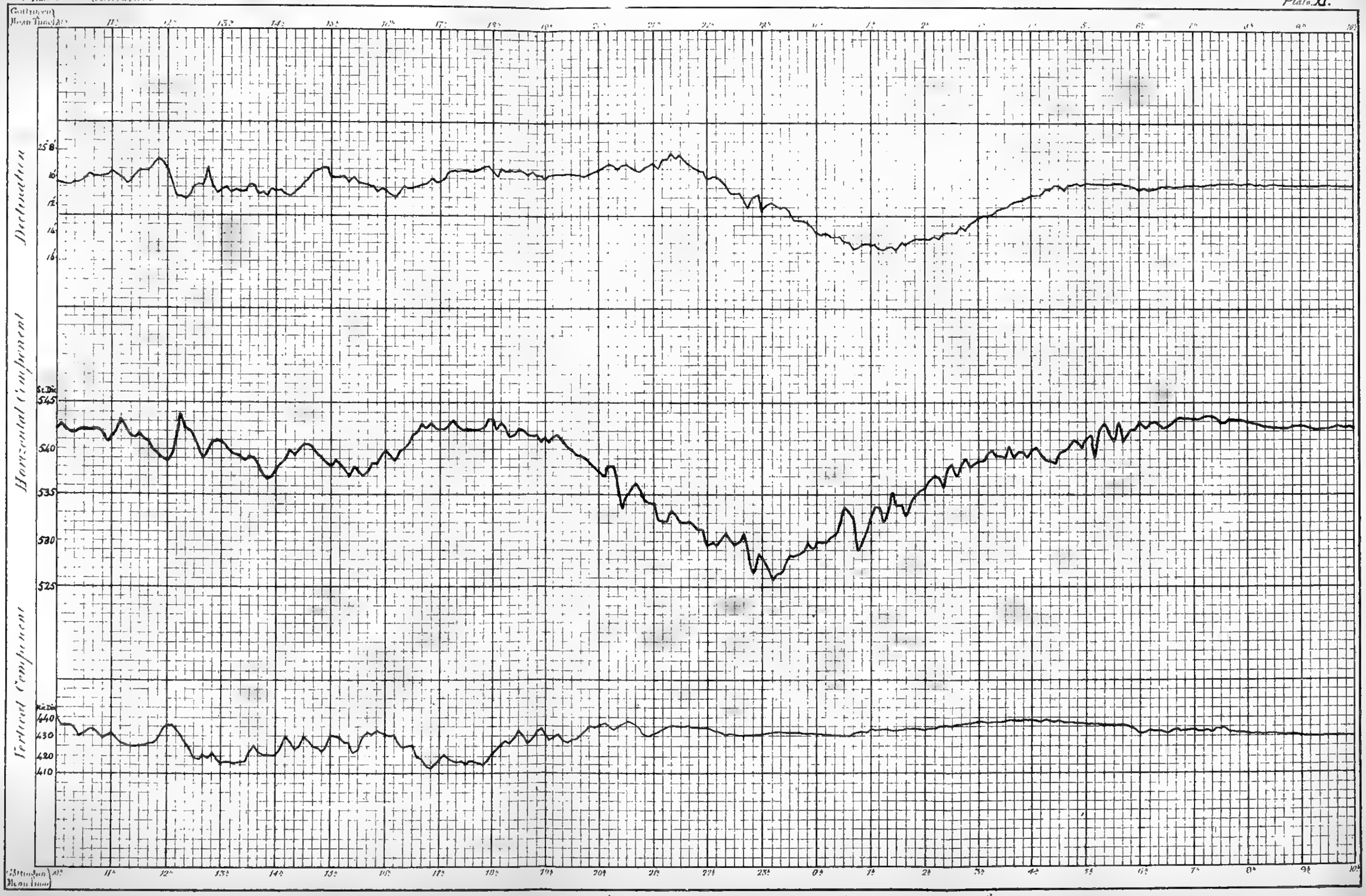
Vertical Component

Ascending Curves indicate decreasing westerly declination and increasing force

Half the usual scale.

Term-Day Magnetical Observations. October 22, 23: 1845.

Plate XI.



Ascending Curves indicate decreasing westerly declination and increasing force.

Term-Day Magnetical Observations. November 28, 29: 1845.

Makerstoun Observations.

Plate XII.

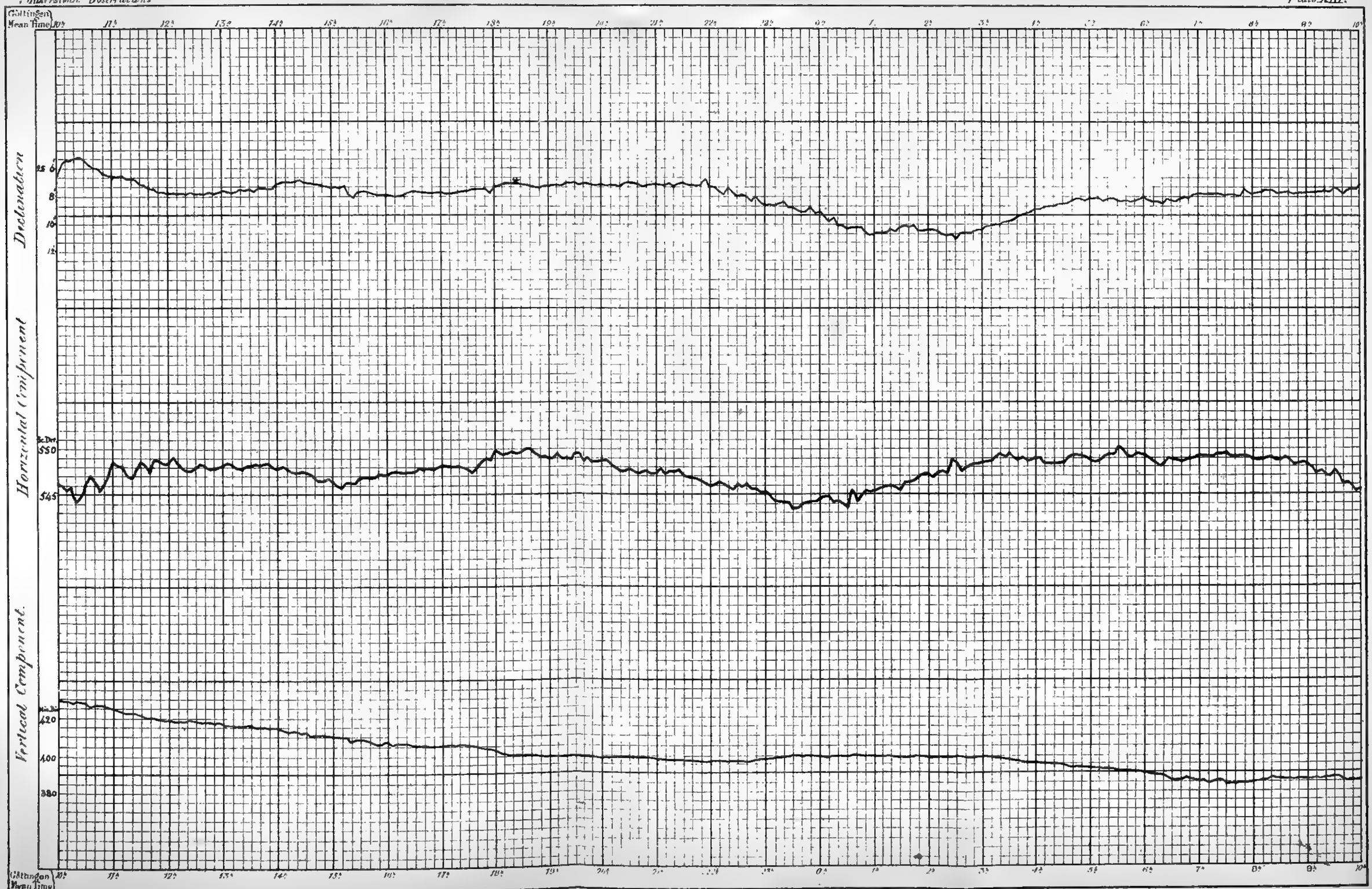
Ascending Curves indicate decreasing westerly declination and increasing force.

MUSEUM

Term-Day Magnetical Observations. December 24, 25: 1845.

Mukerstoun Observations

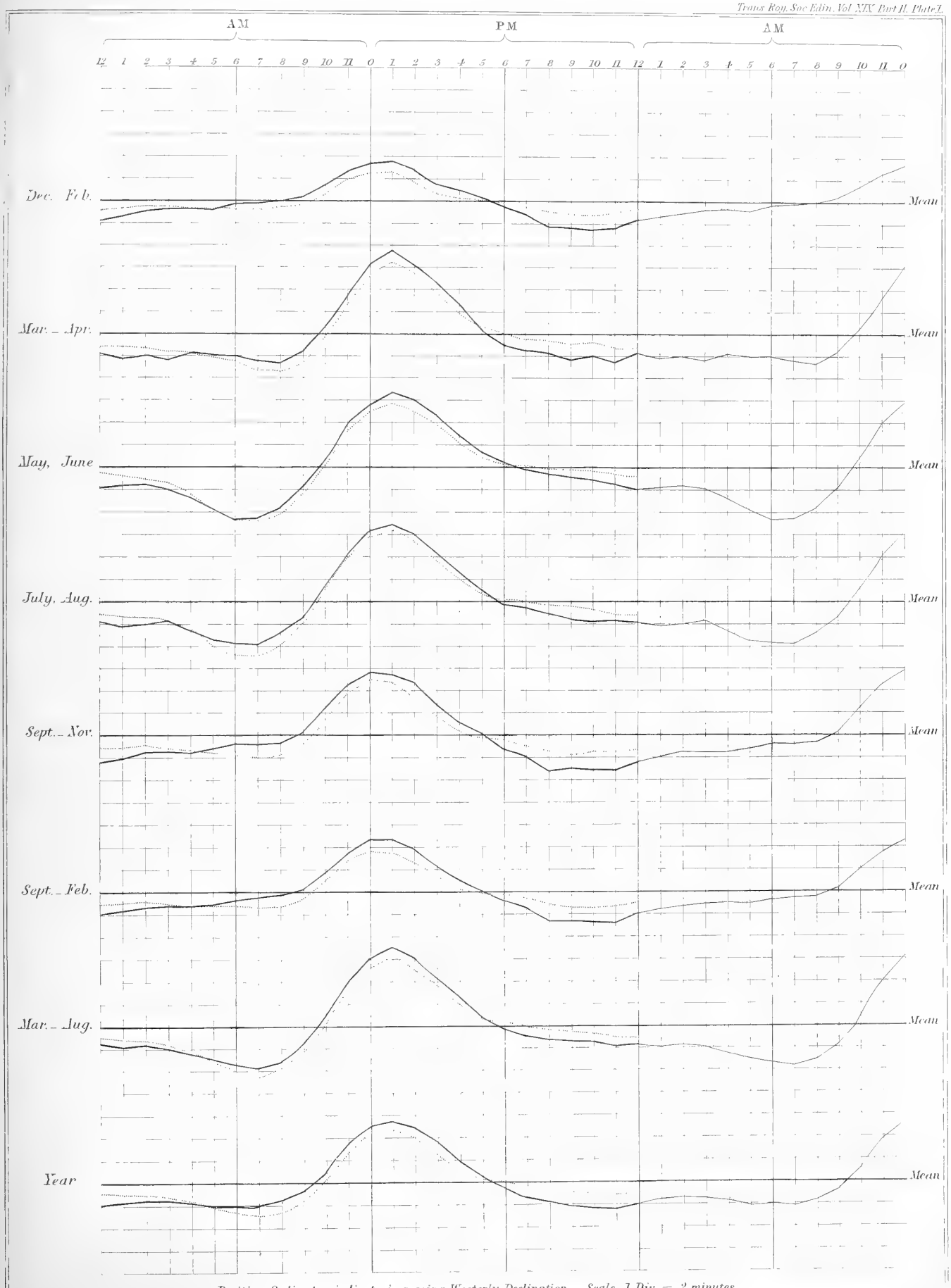
Plate XIII.



Ascending Curves indicate decreasing westerly declination and increasing force.

DIURNAL VARIATION OF MAGNETIC DECLINATION AT MAKERSTOUN 1843-1846.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate I.

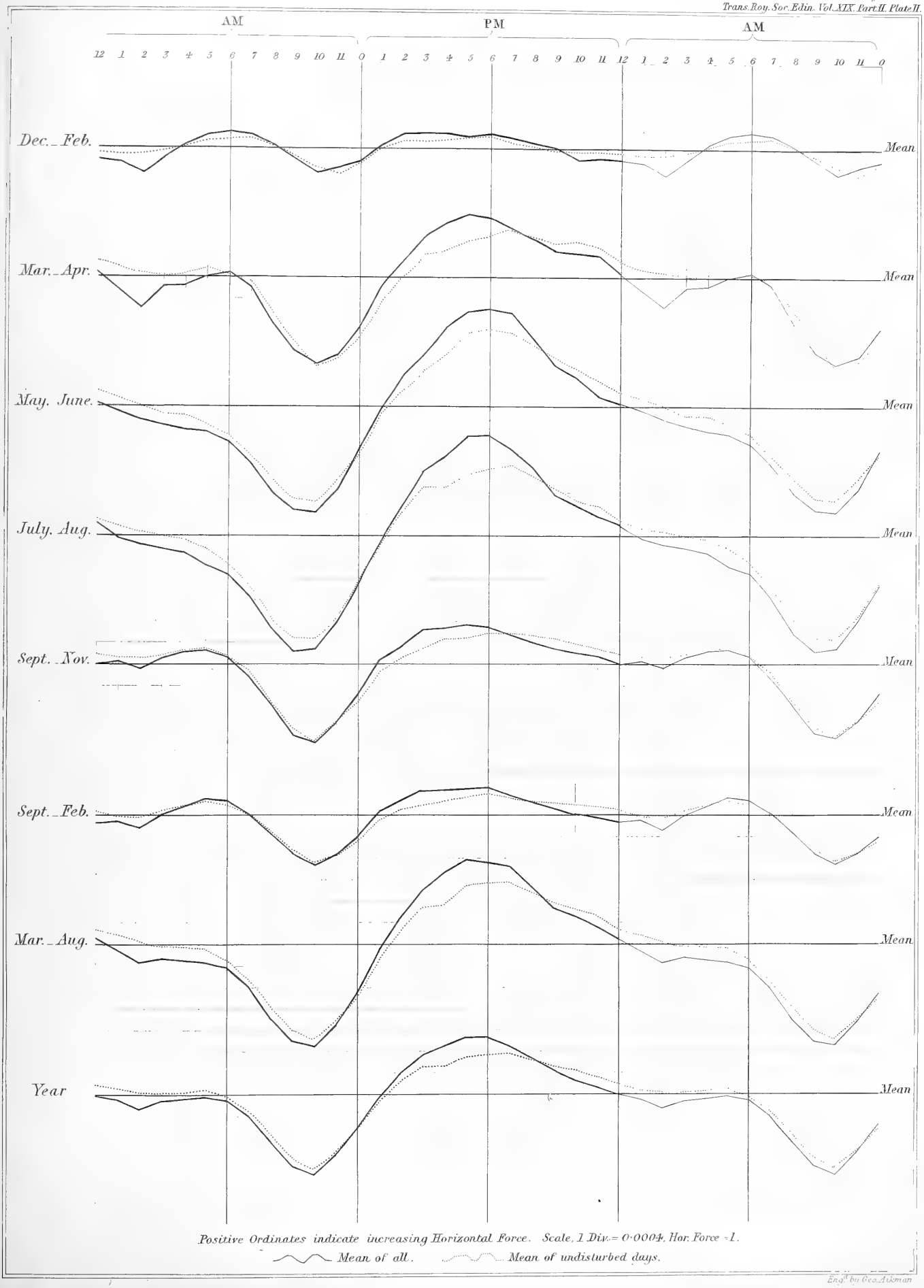


Positive Ordinates indicate increasing Westerly Declination. Scale, 1 Div. = 2 minutes.

Mean of all. *Mean of undisturbed days.*

DIURNAL VARIATIONS OF THE HORIZONTAL COMPONENT OF MAGNETIC FORCE AT MAKERSTOUN 1843 – 1846.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate II.



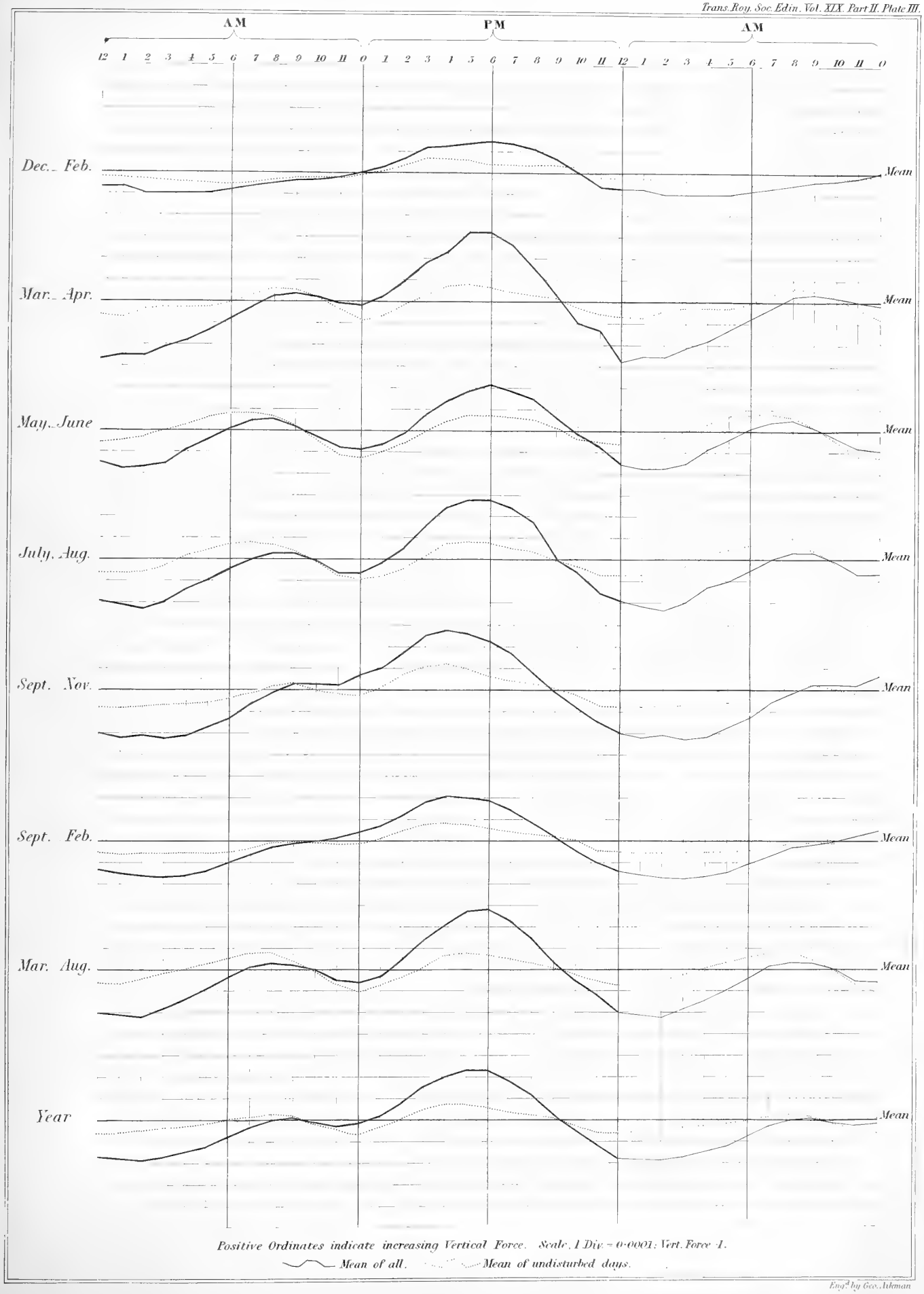
Positive Ordinates indicate increasing Horizontal Force. Scale, 1 Div.= 0·0004, Hor. Force = 1.

Mean of all. *Mean of undisturbed days.*

Engd. by Geo. Aikman

DIURNAL VARIATIONS OF THE VERTICAL COMPONENT OF MAGNETIC FORCE AT MAKERSTOUN 1843 - 1846.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate III.



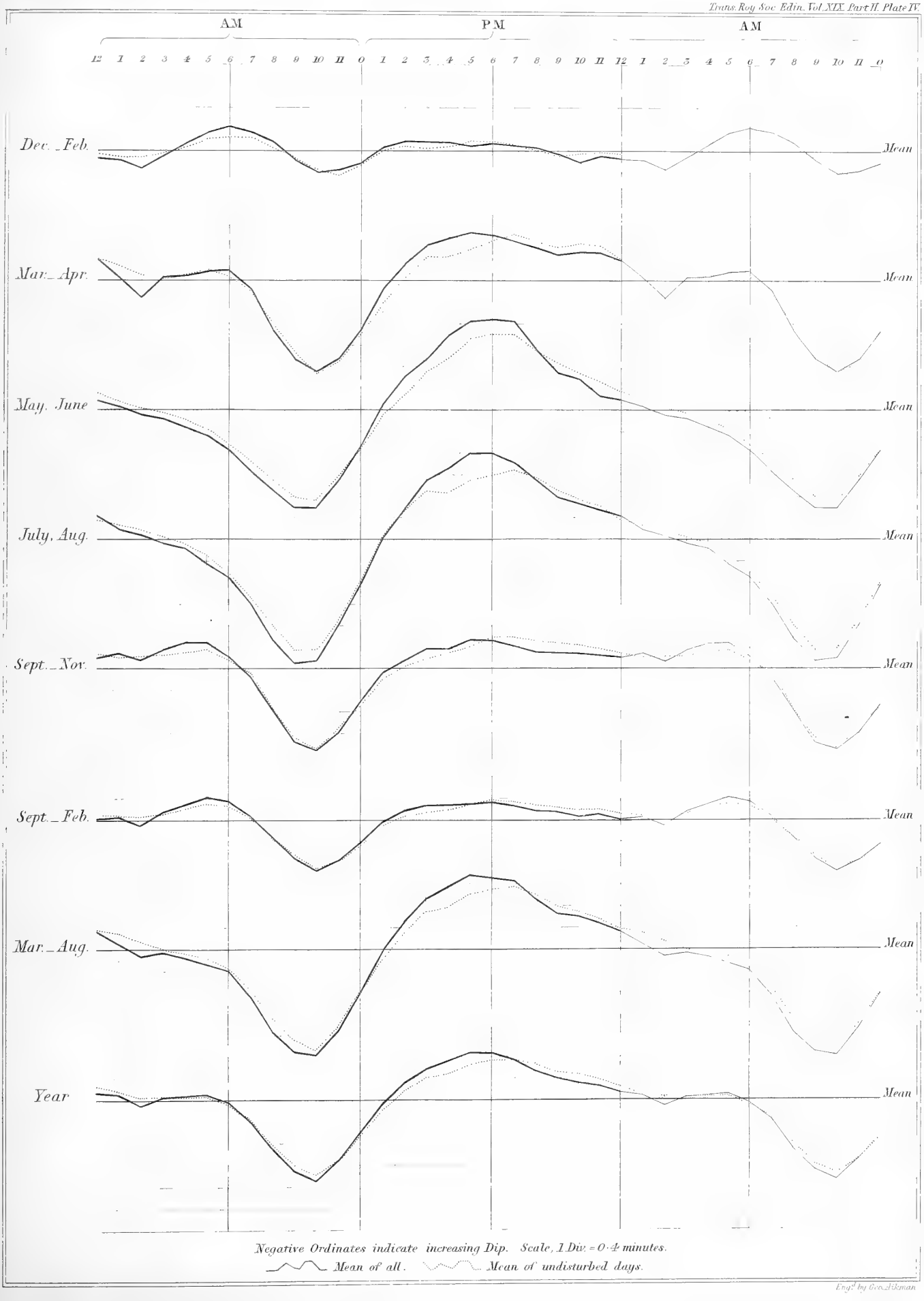
Positive Ordinates indicate increasing Vertical Force. Scale, 1 Div = 0·0001; Vert. Force 1.

Mean of all. *Mean of undisturbed days.*

Engd by Geo. Aikman

DIURNAL VARIATIONS OF MAGNETIC DIP AT MAKERSTOUN 1843–1846.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate IV.



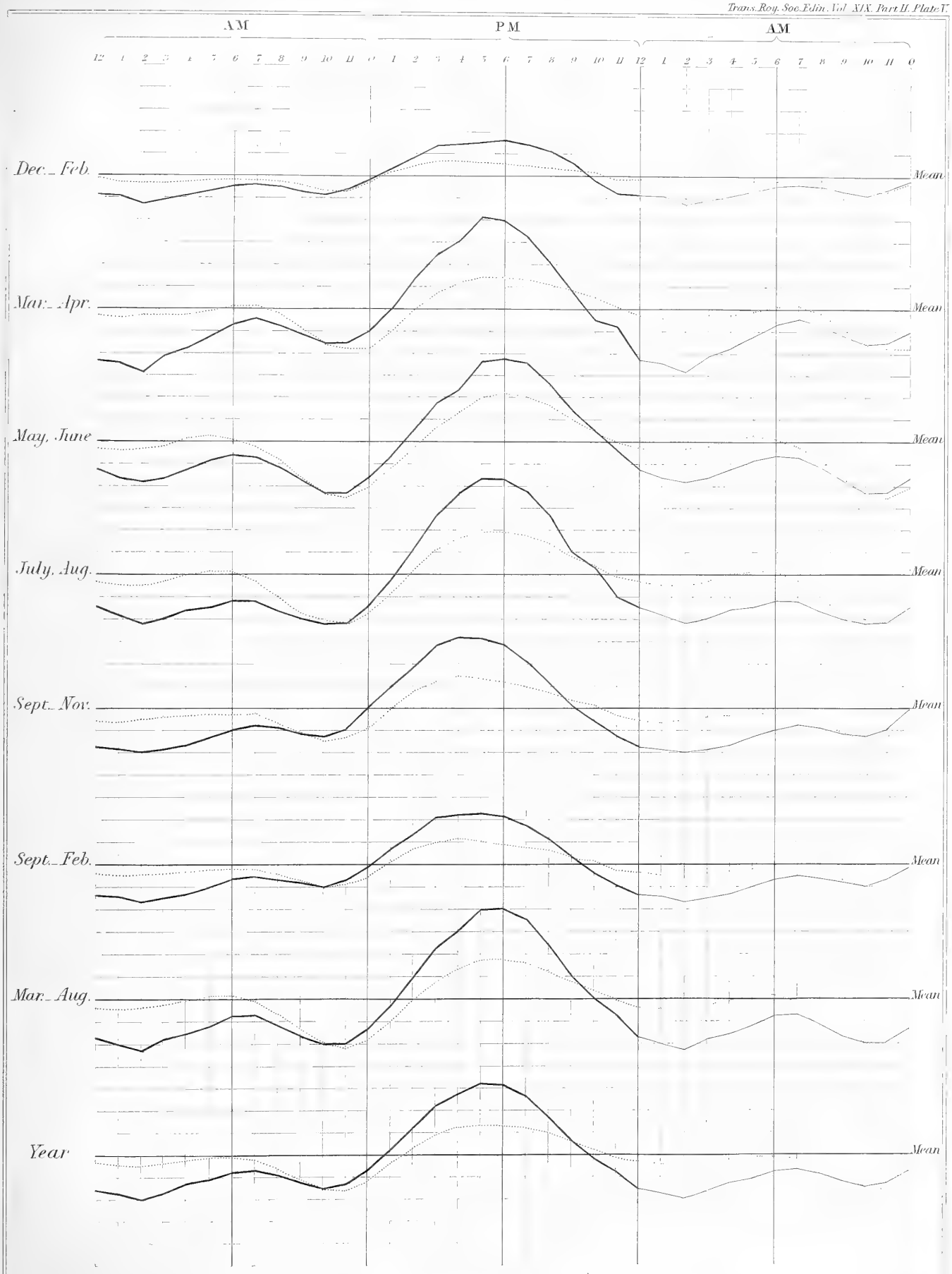
Negative Ordinates indicate increasing Dip. Scale, 1 Div. = 0·4 minutes.

Mean of all. *Mean of undisturbed days.*

Engd by Geo. Aikman

DIURNAL VARIATIONS OF THE TOTAL MAGNETIC FORCE AT MAKERSTOUN 1843-1846

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate V.

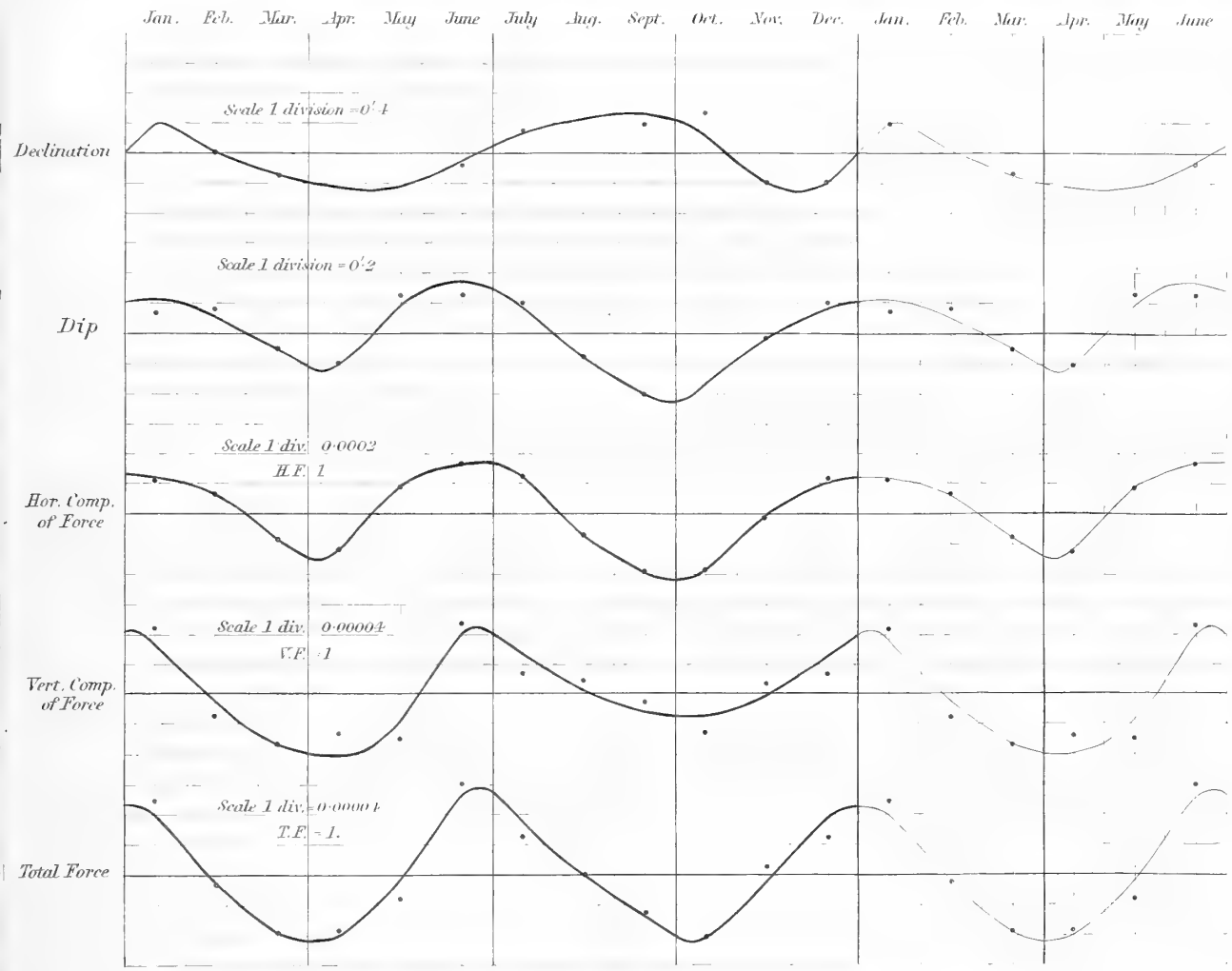


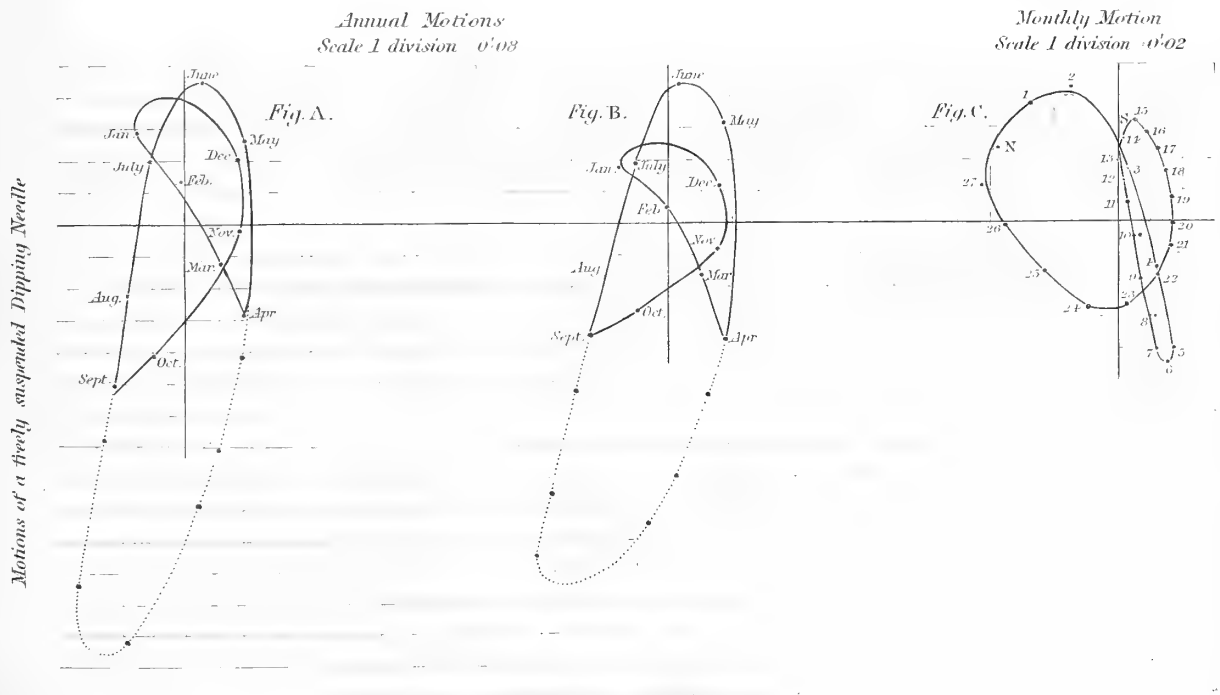
Positive Ordinates indicate increasing Total Force. Scale, 1 Div = 0·0001, Total Force 1

Mean of all. *Mean of undisturbed days.*

ANNUAL VARIATIONS OF THE MAGNETIC ELEMENTS AT MAKERSTOUN 1845–1846.

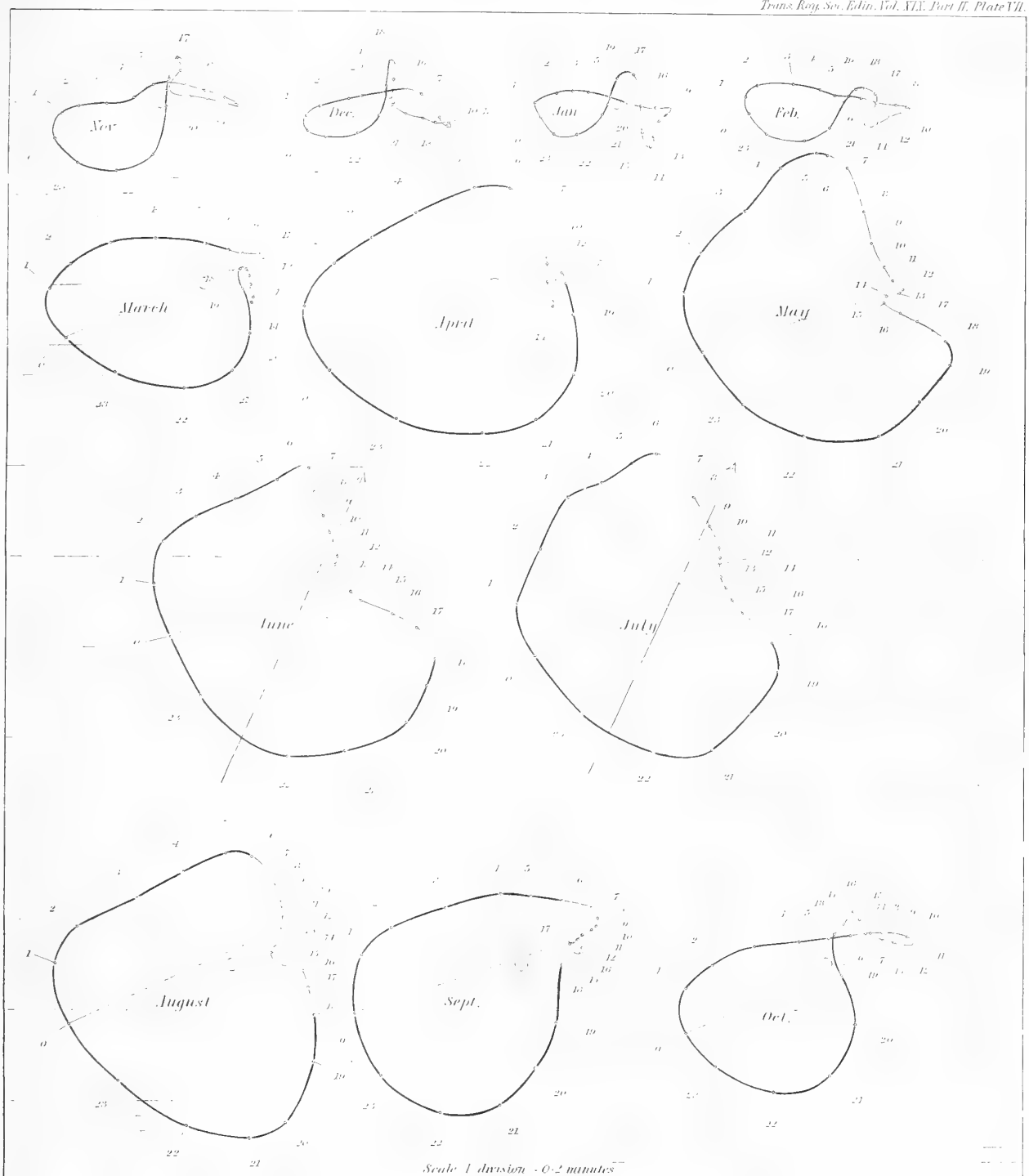
Trans. Roy. Soc. Edin. Vol. XIX. Plate VI.





DIURNAL MOTIONS OF THE NORTH END OF A FREELY SUSPENDED DIPPING NEEDLE
MAKERSTOUN 1845-6.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate VII.



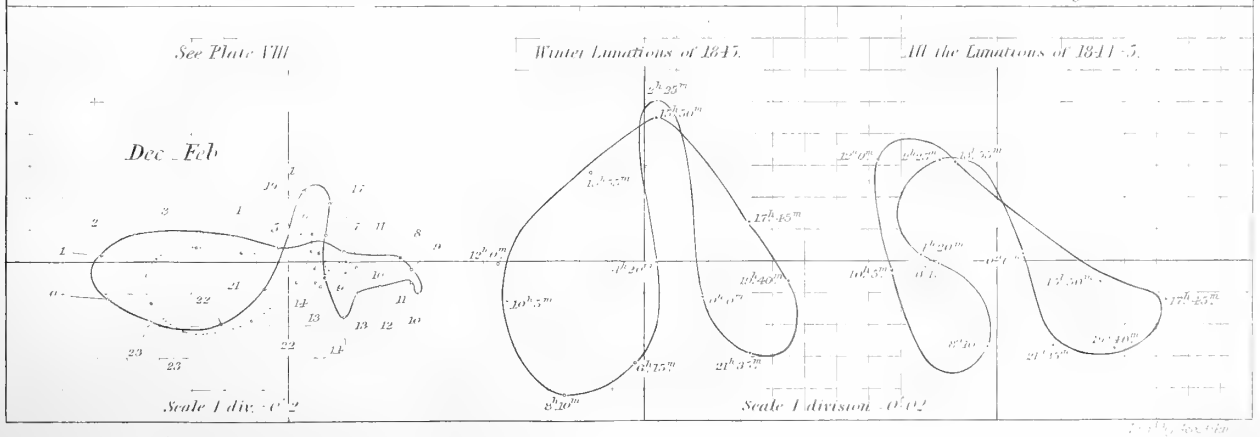
Scale 1 division = 0·2 minutes

Motions with reference to the Moon's hour angles

See Plate VIII

Winter Lunations of 1845.

All the Lunations of 1844-5.

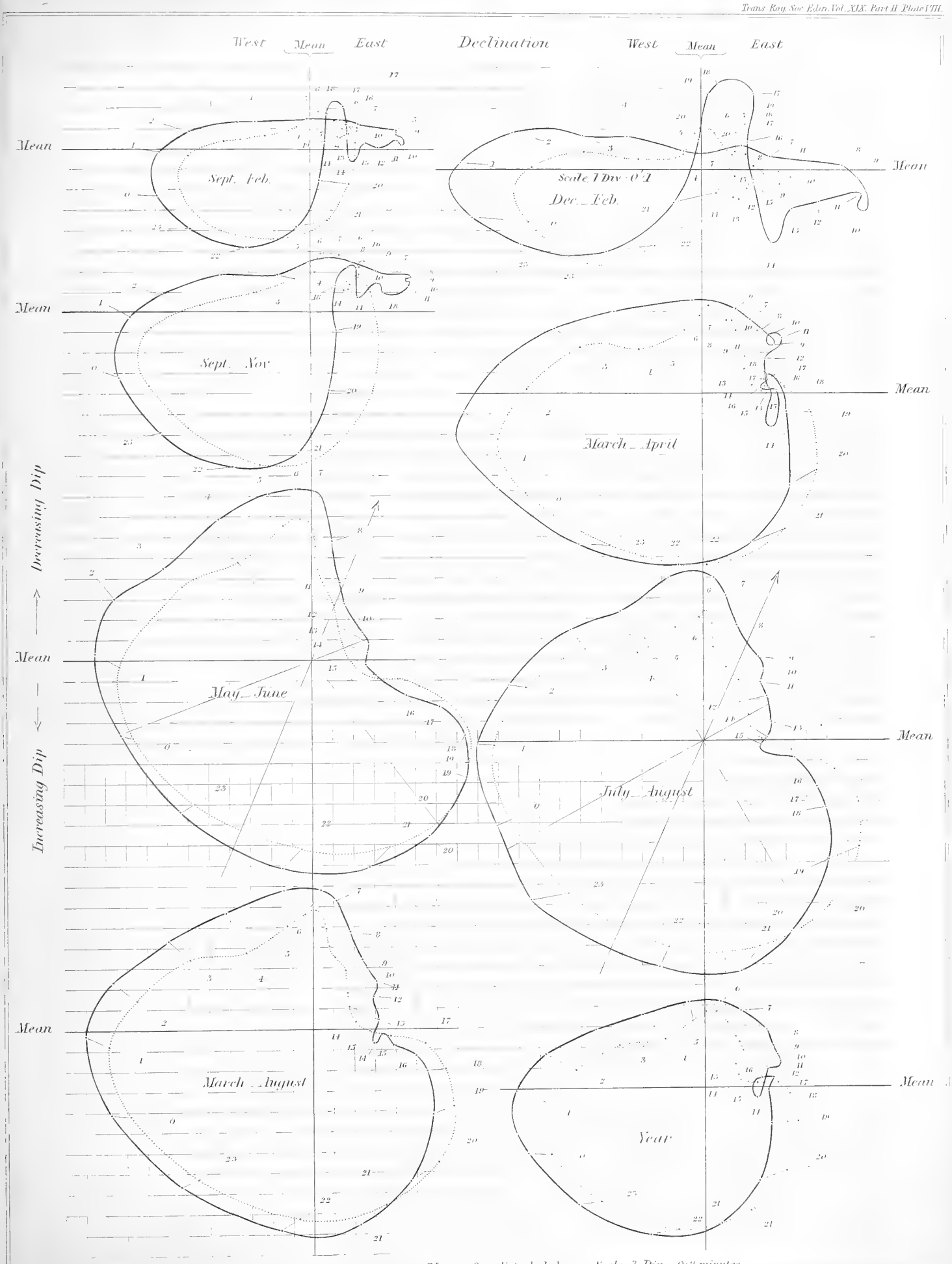


Scale 1 div. = 0·2

Scale 1 division = 0·02

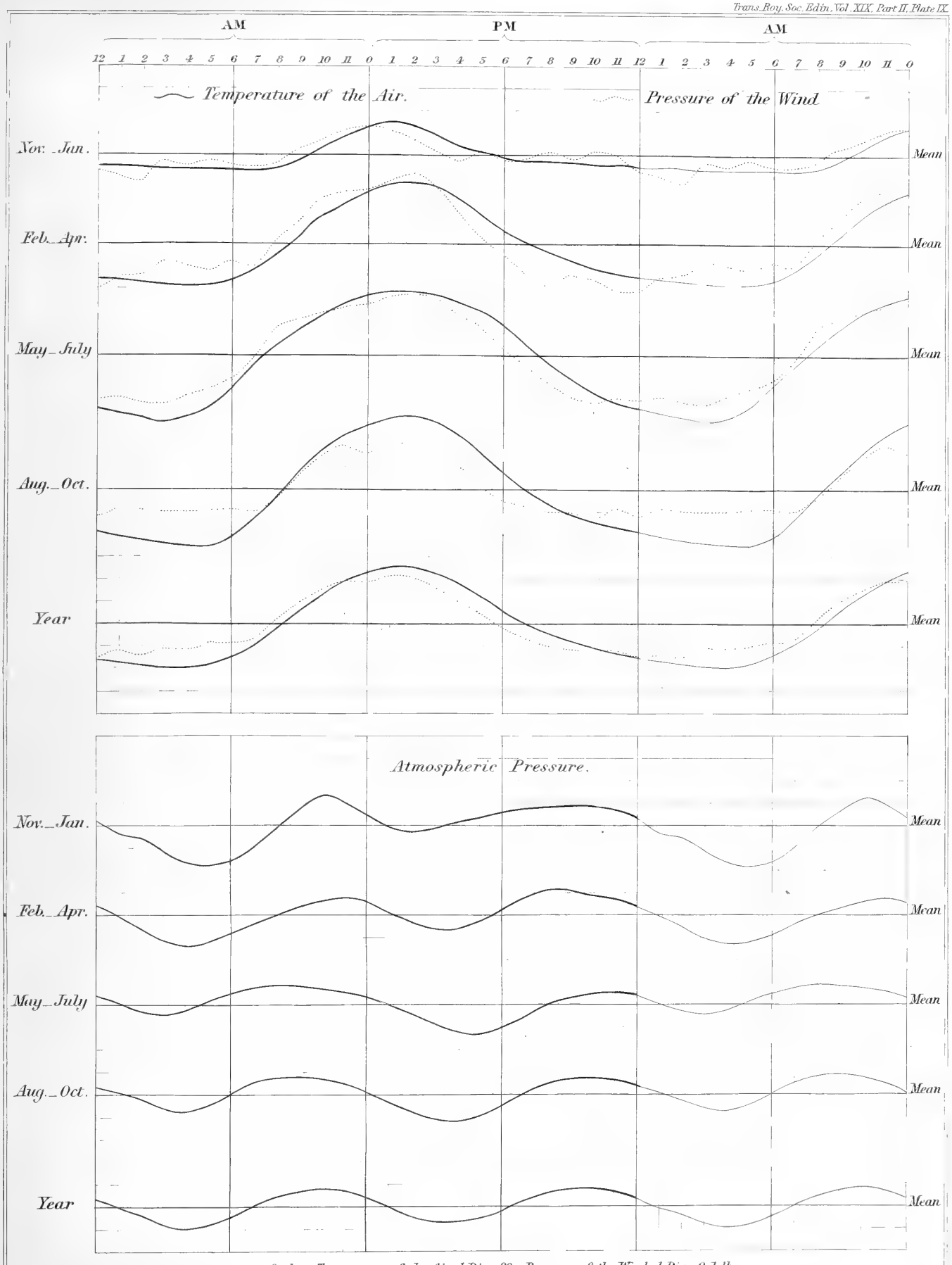
DIURNAL MOTIONS OF THE NORTH END OF A FREELY SUSPENDED DIPPING NEEDLE, MAKERSTOUN 1843–6.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate VIII.



METEOROLOGICAL DIURNAL VARIATIONS AT MAKERSTOUN 1843–1846.

Trans. Roy. Soc. Edin. Vol. XIX. Part II. Plate IX.



Scales. Temperature of the Air, 1 Div.= 2°. Pressure of the Wind, 1 Div. =0·1 lb.
Atmospheric Pressure, 1 Div. =0·01 inch.

Engd. by Geo. Aikman

REPORT

TO

GENERAL SIR THOMAS MAKDOUGALL BRISBANE, BART.,

G.C.B., G.C.H., D.C.L., LL.D., F.R.S., F.R.A.S., H.M.R.I.A., PRESIDENT OF THE ROYAL SOCIETY OF EDINBURGH, AND CORRESPONDING MEMBER OF THE INSTITUTE OF FRANCE,

ON THE COMPLETION OF THE

PUBLICATION, IN THE TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH.

OF THE

OBSERVATIONS MADE IN HIS OBSERVATORY AT MAKERSTOUN.

By JOHN ALLAN BROUN,

LATELY DIRECTOR OF THE OBSERVATORY.

EDINBURGH:
PRINTED BY NEILL AND COMPANY.

MDCCCL.

April 1842, Mr Russell having resigned, the observatory was placed under my direction, the same system of observation being continued. In the end of that year I suggested the propriety of increasing the number of daily observations, an increase which would require the services of another observer; this suggestion, which was seconded by the opinion of Professor J. D. Forbes, was at once approved by you, and Mr John Welsh, a talented student in arts of the Edinburgh University, was, at my recommendation, appointed by you as my assistant. The series of observations obtained in 1843 was necessarily still incomplete, no observations were made after 9^h P.M. nor before 5^h A.M., excepting on term-days and during magnetic disturbances: it was evident, therefore, that determinations of the diurnal laws would still be desiderata; while it was equally evident that a complete diurnal series would at once satisfy these wants, and render the previous incomplete series of greater value. I then suggested the addition of another observer to the establishment, pointing out, however, the most economical way in which this addition could be made, and especially the fact that it would render unnecessary the extra assistants required on term-days. These suggestions were made throughout with the full knowledge that they were in accordance with your object and wishes. I have merely to state the readiness with which you adopted this suggestion and every other tending to the advancement of the work of the observatory. Mr Alexander Hogg, an ingenious mechanic, who had been engaged in the construction of the observatory (which was performed chiefly under his superintendence), and who had been engaged under Mr Russell, at the first, and under myself afterwards, as an observer on the term-days, was recommended by me, as not only fitted for an observing assistant, but also as likely to be of much use in matters of handicraft connected with the observatory and its instruments: he was accordingly appointed in the end of 1843. In 1844 and 1845 a series of observations of all the magnetical and meteorological instruments was made hourly, excepting on Sundays.* It was originally proposed that this hourly series should extend through only two years; in 1846, therefore, the same system was adopted as in 1843. With the year 1846 terminated the period contemplated for the extended work of your observatory, and the period contemplated by the Royal Society of Edinburgh in adopting the large volumes of observations as portion of their Transactions. A more limited series was made in the following years, 1847, 1848, and 1849.

* I may remark here that the omission of observations on Sundays, even of the great and unusual magnetic perturbations, which has excited the astonishment of our German co-labourers, and especially of the Baron Von Humboldt, like the omission of many other works on the same day, has never been felt as any loss. The amount of simultaneous disturbance observations in existence, made on the six week-days, is greater than we are likely to make any use of. It had not occurred, perhaps, to our continental friends that there was any difficulty in determining the kind of scientific work which would not be a "sin upon an English Sunday," as their own limit, if they have any, is not of a very stringent character.

The first part of the Makerstoun Observations was published in June 1845, and the last part appeared in June of the present year: the last part contains the detailed tables of *results* for the years 1845 and 1846, together with the general results of all the observations, including the monthly means of observations made in 1847, 1848, and 1849. The Makerstoun Observations have appeared as a portion of the Transactions of the Royal Society of Edinburgh, that body having liberally granted £600 towards the expense of printing; a grant for one object which, I am satisfied, will bear comparison with the grants of much richer societies.

I shall now notice some of the more salient matters in connection with the Observatory itself and its instruments.

The Observatory.—The geographical co-ordinates are—

Latitude, 55° 34′ 45″ N.

Longitude, $0^h\ 10^m\ 3^s{\cdot}5$ W. of Greenwich.

Height of the barometer cistern above mean water at Berwick, 213 feet.

The observatory is constructed of wood, like that at Greenwich; its architectural character is not of the highest order; it is placed on a small rising ground which is probably formed of felspathic trap, covered with rolled boulders, pebbles, and gravel. The internal division of the building, and the number, size, and positions of the windows are ill adapted for the purposes of the observatory. The plan and elevation were due to an assistant in the Dublin Observatory. Care was taken to exclude iron completely from the structure, copper nails having been used throughout: the telescopes and instruments were placed upon excellent white sandstone pillars, well-founded, and unconnected with the floor. The care taken in this matter is the most deserving of praise in connection with the construction of the observatory, and that care was chiefly or altogether your own. It should not be forgotten that the knowledge of the best arrangement for such a building was very small at the time it was planned, if it is considerable now.

The range of temperature within the observatory was much too great, owing to the thinness of the walls, and the number and largeness of the windows. The building was at first heated by copper stoves which soon became oxidated, and produced suffocating fumes of most hurtful character. It was altogether impossible to approximate to anything like uniformity of temperature in a house so easily affected by external variations. The stove was discontinued in 1843, and a small brick building erected at a distance for a computing room in winter. I proposed, in 1843, to heat the observatory with hot water pipes, but the difficulties connected with this process were too considerable to render the experiment desirable. It was found possible in 1845, to erect a fire-place with a tubular brick chimney in one of the ante-rooms, which, though wholly useless for heating

the observatory, served to render the small room in which it was placed sufficiently comfortable for a computing-room.

The Instruments.—The declination and bifilar magnetometers were made by Mr Grubb of Dublin. The magnets during 1841 and 1842 were enclosed by loosely fitting cylinders, resting upon the pillar tops, covered by glazed lids; but the junctions were neither pressed together by any contrivance, nor was there any moderate precaution taken to prevent currents of air from circulating in the boxes. In 1843 and 1844, these and various other defects were removed: the joints were lined with velvet and pressed firmly together; rectangular boxes were placed within the drums; both cylindrical and rectangular boxes were gilt outside and inside; and the whole apparatuses were covered by thick cotton hoods. The gilding prevented the effects of radiation in producing currents within the boxes; the other precautions prevented the entrance of external currents, and secured to a considerable extent a uniform temperature and dryness.

The suspension threads for the declination magnet broke at short intervals in 1841 and 1842; they were succeeded in June 1843 by a thread carefully prepared, which is still in use, and apparently as good as ever. In case, however, the suspension thread should have received any torsion, the magnet was removed occasionally, a brass bar was suspended, and the torsion was rendered zero for the magnetic meridian before replacing the magnet; when little torsion was found existing the trials were made seldomer, as the mere manipulation was apt to introduce torsion of itself.

Errors due to twist in the suspension wires of the bifilar magnet, were eliminated by the process employed to determine the unit-coefficient. The interval of the wires was adjusted according to the instructions by the Committee of the Royal Society; but this rendered the instrument too sensitive, and, during moderate disturbances, the scale went out of the field of the telescope. This was attempted to be remedied at the time by turning the torsion circle till the scale reappeared, generally a difficult and unsatisfactory operation; in 1846, however, I employed a small magnet for the purpose, this being placed at known distances where its effect upon the bifilar magnet was determined.

Even for the ordinary diurnal movements, however, the instrument was too sensitive; the reading of the magnet scale was estimated to one-tenth of a division, and of the thermometer to one-tenth of a degree, but a variation of one-tenth of a degree in the temperature of the magnet is equivalent to two-tenths of a scale division in its motion. The thermometer was placed with its bulb resting on a brass bar, so that it might show as nearly as possible the temperature of the magnet.

The balance magnetometer was made by the late Mr Robinson of London; the box was gilt inside and outside, and covered with cloth as in the case of the other instruments. The magnet was never lifted from its support, excepting

during the adjustments; it was vibrated through small arcs only. Many of the apparent anomalies which I have observed in this instrument, and described in the Edinburgh Transactions, were probably due to the facts. that the needle rests upon knife edges, and that every care being taken in the management of the instrument, the consequences of such a mode of support were exhibited under the most favourable circumstances.

I have referred to the imperfections of the inclinometer, in the introductions to the various volumes; one error I believe to be due to the presence of iron in the copper circle or basement of the instrument.

The barometer, a standard by Mr NEWMAN, was fixed to the south wall of the west ante-room, not the best possible position in the observatory, as it was subjected to greater variations of temperature than it would have been if placed to the north. The thermometers were placed on a revolving frame in front of one of the north windows; but the case was removed to the west in the morning, and to the east in the evening, when the sun shone near to, or north of the prime vertical. The anemometer is sufficiently well-fitted for the determination of the laws of variation, but there is considerable uncertainty as to its value for giving absolute results, as there is with most of the anemometers yet in use. From various causes, the working of the anemometer became less trustworthy in 1848 and 1849.

Times of Observation.—The ordinary observations were made at certain previously arranged hours and minutes of Göttingen mean time. When the observer, from any cause, was too late for his observations, he was requested to note the exact minutes when the observations were made; this was done in all cases, and the true minutes will be found in connection with the printed observations. No check-clock was used, and none was necessary. Indeed, it is my opinion, where little confidence is placed in some portions of the labours of assistants, they will generally, in consequence, be found to deserve little trust in others; and this is especially true in the work of an observatory, requiring such a *various* fidelity and care. Besides the regular observations, large masses of observations were made during magnetic disturbances and other occasional phenomena.

Reductions.—Before the reductions of the magnetical observations could be completed, certain factors were requisite, representing the effect of one degree Fahrenheit on the positions of the bifilar and balance magnets, and the values of a given change of angular position in terms of some known or easily found unit. It is not necessary that I should do more than refer to the fact, that I have proved the insufficiency of the processes originally prescribed for the accurate determinations of those co-efficients and have substituted new ones, of the accuracy of which there can be no doubt, as they have been verified in every possible

way.* I mention this, chiefly to remark upon the time and labour bestowed on the investigations for these important objects. Could I have been satisfied with issuing the volumes of observations from the press uncorrected, as has been done in many cases, or have reduced them by the official methods, the volumes might have been published immediately after the observations were made, as all the ordinary portion of the reductions were performed, and were verified week by week. The whole value of such observations, for any present use, depends upon these reductions: erroneously corrected observations are as useless as if they were uncorrected; and to publish them in an uncorrected state would be simply to place the volumes on the shelf, with large masses of other like valuable works, till their proper reduction and discussion at the period vulgarly denominated the Greek Calends. It is conceived, therefore, that the great amount of labour was well spent, which was necessary, *first*, in attempting to obtain satisfactory results from the old processes; *second*, in gradually developing and perfecting the new ones; and, *third*, in rendering the factors deduced as accurate as possible, by getting rid of those errors which are unavoidable in the employment of new methods. It is conceived also, though this well-bestowed labour were forgotten, and by far the greater part of it has never shown itself in print, that the speed with which the volumes have appeared, will do no discredit to your observatory, nor to its director with one complete and one partial computing assistant.

Printing.—Considerable time was bestowed in arranging the observations into the best forms for printing; many condensations and improvements were gradually adopted till, it is believed, that the volumes for 1844, 1845, and 1846 have been printed in the most distinct and condensed way to be unabbreviated; it would have been a great saving of *time* to have had them printed in twice the bulk. The proofs were carefully revised by my assistants and myself; almost every sheet passed through my own hands before sending to press.

Division of Labour.—The general management of the observatory, with the correspondence and all other matters relating thereto, devolved upon myself. I took a regular share of the work of observing night and day, especially in the years 1843, 1844, and 1845, and, with Mr Welsh, performed the principal portion of the work of computing, and of the more difficult class of absolute observations. I also made, with Mr Welsh, the astronomical observations of transits, &c., and performed other occasional work required by yourself.

* The imperfect system of determining the temperature coefficients by removing the magnet from its place in the instrument to water baths, has been retained in opposition to anything like scientific caution, after its insufficiency has been demonstrated in the case of instruments by the best makers, treated with *at least* an average care.

Mr Welsh shared in all the work of observing and computing. A large mass of observations of the new planets were made with your large equatorial, chiefly by Mr Welsh, at extra-official hours; these observations have been published by the Royal Astronomical Society.

Mr Hogg shared in the regular and disturbance observations, assisted in the computations, and performed all the mechanical work connected with the observatory and its instruments.

I have already noticed, in different Introductions to the Makerstoun Observations, the diligence and care of my assistants. I shall here repeat my obligations to Mr Welsh, who was trained from the commencement under my own eye. His acquaintance with the mathematical details of his work, his skill as an observer, his fidelity in all he performed, and his appreciation of the practical difficulties occurring, have been of the greatest importance to me. He was made conversant with all my own views upon the theoretical and practical questions which so often developed themselves, and, in return, I frequently derived considerable benefit from his opinions.

To Mr Hogg, also, I can award my testimony as to the honesty and diligence with which he has fulfilled the duties for which he was at first engaged. To his invention and handicraft most of the mechanical contrivances, in wood and brass, about the observatory are indebted.

Suggestions.—I shall now offer a few suggestions, the results of my experience, on the subject of magnetical and meteorological observatories, especially in such climates as our own.

Situation.—I need scarcely say that it is of importance, especially for absolute magnetical determinations, that the position chosen for the observatory should not be over highly ferruginous rocks, even though observations can be made in the neighbourhood to determine any local error. But there is a point connected with the placing of magnetical and meteorological observatories which it seems to me is of very great importance, a point which has been apparently overlooked to a very great extent; I mean the influences due to the proximity of large cities. These influences, I fear, are much greater than may be suspected, and that not only on the absolute values, but likewise on the variations, whether magnetical or meteorological. Suppose an observatory placed on one side of a large city, which contains immense masses of iron, huge piles of stones, and thousands of human beings; this combined mass has a temperature several degrees higher than that of the air at a distance; it is a generator of electrical, thermal, and aërial currents: have these no effects upon the magnetical and meteorological states of the neighbouring district? The probabilities appear all in favour of an answer in the affirmative, and, at least, till the negative can be

proved, it is evidently contrary to all sound investigation to incur the risk of ills we know not of. I feel inclined to attribute some curious discrepancies betwixt the results obtained in town and country observatories to some such causes.

The building to contain the variation instruments and computing room, should be made of stone if possible, even though it should contain some *small* quantity of iron. It is of the greatest importance that the temperature within the instrument room should be nearly uniform; for this end, stones or *logs* of wood are essential; I do not believe that any small quantity of iron which analysis might detect would affect the *variation* results. In the construction of the observatory, however, an important matter has always been lost sight of: it is nearly impossible that the temperature in our climate can be very uniform without a complete exclusion of the external atmosphere. Such an exclusion has been attempted by sealing up the observatory, and by burying it under ground; methods which might have served for the instruments, but which would in a short period have served for the observers too. It appears essential, then, that the instruments should be placed in a different room from the observer: this room should be wholly *within* the observatory, with passages or rooms around it, separating it on all sides from the outer wall: the telescopes could be placed in the wall of this room, the eyepieces being outside; a single glazed aperture with a lamp and proper arrangement of mirrors would serve to illuminate all the scales. There should be no windows, and only one (*double*) door into the room which could be well closed, and would require to be opened only at considerable intervals. The roof of the observatory should slope only to the north, so that the sun could not beat on it, or some arrangement should be made by a double roof, to prevent the heating there from affecting the internal temperature.

By such arrangements, the diurnal variation of temperature would be scarcely appreciable within the magnetometer boxes. It would be necessary, in order to determine the temperature co-efficients, either that this room could be opened for some time to the variations of the external temperature, or that it should be possible to heat it artificially: this might be done by a stove, or by pipes with hot water laid in the external room, which could be used as a computing room. The annual variation of temperature might be very much diminished, and the dryness of the instruments be insured by this arrangement. It is to the effects of varying temperature and humidity, that the principal errors are due for the three variation magnetometers.

Having suggested what I conceive to be the best position for the variation magnetometers, I would remark, shortly, with reference to the dry and wet bulb thermometers, that they ought not to be placed in a *recess* to the north: a position which, although sufficiently shaded from the sun, is, however, in general wholly abnormal; it is generally damp, and if the house be of stone, of a consider-

ably lower temperature than in the shade elsewhere.* The thermometer case should, I think, be placed to the north of the building, not in a recess, but sheltered from the sun's rays in the morning and evening by large double boards placd at a moderate distance, and permitting a free circulation of the air: the case itself should be similar to that employed at Makerstoun, or of a lighter construction, which can be turned round from within the observatory, so as to allow the observations to be made from one of the windows, the glass of which prevents the effects of radiation from the body of the observer, or from the lamp during night.

The Declinometer.—This instrument, which is of the simplest possible construction, requires no correction for the effects of temperature; it has generally, therefore, been *the* instrument in observatories, the only one from which laws of variation might be expected with little trouble, yet the observations have in general been overrun with errors. The errors of the instrument are due chiefly or altogether to the suspension of the magnet.

The French Academy of Sciences thought the mode of suspension of the declination-magnet of so much importance, that they offered it as the subject of a prize in the year 1777; previously the needle was balanced upon a pivot as in our common mariner's compass. The prize was carried by COULOMB, who proposed suspension by means of a thread formed of the silk fibres from the cocoon. This suspension was adopted immediately after by M. DOMINIC CASSINI; the old cap and pivot suspension was used, however, for some time afterwards, as by GILPIN, early in the present century. CASSINI seems to have soon become aware of the effects of humidity, and of separation of the fibres, in introducing torsion into the thread; for he prepared his threads by first gumming the fibres together, and then greasing the thread. It is obvious, however, that, after all,

* As I will not again allude to the meteorological instruments, I may mention here my doubts as to the accuracy of the theory of the wet bulb, even as a measurer of the humidity of the locality in which it is placed; and my perfect belief that the determinations of the vapour pressure in the atmosphere, obtained by means of the dry and wet bulbs, are wholly in error. I have indicated this opinion in different volumes of the Makerstoun Observations, where I have also shewn that the apparent success of an attempt made by M. DOVE, and lately by Colonel SABINE, to resolve the diurnal variation of the total pressure of the atmosphere into two simple variations, is in all probability due to the large but erroneous diurnal variation of aqueous vapour pressure obtained in the mean for the year; which, when subducted from the smaller double variation of the total pressure, leaves traces only of its own abstraction. I have shewn that this is the more certainly true, since, when we consider winter only, the variation of the aqueous vapour pressure, as computed, being then very small, the pressure of the *dry air* then exhibits a well marked *double* diurnal variation as before. I do not enter in this Report into the Results of the Makerstoun Observations. I do not mention the previous fact to shew that the pressure of aqueous vapour is not involved in the diurnal variation obtained from the barometer, but as some evidence that the pressures deduced from the dry and wet bulbs are not to be trusted. I have proposed and attempted some experiments for the purpose of obtaining the *actual* value of the vapour pressure in the atmosphere, by destroying the moisture in a closed apparatus, but have not yet succeeded, owing to imperfections in the instrument.

I am glad to learn, since the above was written, that Colonel SYKES has also, in a paper read before the Royal Society of London last session, objected to the results from the psychrometer.

the threads thus constructed must have performed very indifferently; for his observations, which were made at the same time in the Paris Observatory, and in the caves below, shew differences and variations in the monthly means which are not explicable by anything within our later, and, as we may suppose, more accurate experience. Since CASSINI'S time, the improvement of the suspension-thread seems to have made very little progress. M. KUPFFER, apparently despairing of satisfactory results from a silk suspension, substituted silver wires in the Russian declinometers; a similar suspension has also been employed by M. QUETELET at Brussels. This seems to me a step towards the cap and pivot suspension. Indeed, M. NERVANDER of Helsingfors has found that such suspension cannot be trusted, since the wires are so affected by temperature that, when an unmagnetic bar is suspended, it has a considerable diurnal motion: a fact which I had suspected, and had pointed out as a probable source of error in determining the temperature coefficient for the bifilar magnet.

The suspension-thread acts in the following manner:—As the thread is composed of a series of fibres more or less twisted, the plane of detorsion, that is, the vertical plane in which an unmagnetic bar will rest when suspended, is determined by the composition of series of opposing forces: if the torsion of the individual fibres be at all considerable, very small motions of the magnet will cause them to occupy slightly different positions *inter se*, or moderate changes of humidity acting to a greater extent upon the external than the internal fibres, and upon some of the external fibres than upon others, will change the plane of equilibrium, and in this way force the magnet from its true position. Changes of the plane of detorsion caused in this way, and by the occasional breaking of fibres, will explain the great discrepancies occurring in large series of observations, and the consequent lessening of their value. The importance also of obtaining properly-constructed suspension-threads will be at once evident, when it is remembered, that unless such are obtained, the labour of years may be rendered of little or no value. The conditions sought to be obtained in the construction of the thread for the Makerstoun declinometer, were the following:—*First*, The absence of all torsion from the fibre. The so-called *untwisted* compound fibre from the cocoon, usually employed in observatories, receives a considerable twist in the operations of drawing from the cocoon and reeling, as may easily be perceived by passing it between the thumb-nail and index, the method which I employed to remove the twist. *Second*, That each fibre when combined into the thread, shall bear an equal portion of the weight. For this end the fibre was not cut into pieces, but a sufficient length being obtained, free of flaws, it was wound round two smooth pins, placed at the required distance, so that no twist should be introduced in the act of winding; when a sufficient thickness was obtained, and the ends were tied, a hook attached to a weight was inserted in place of the lower pin; the thread being formed of one continuous fibre was thus free to move round the upper pin and the weight-hook

till each length of fibre bore nearly an equal strain. *Third*, That the thread should be as small as is consistent with durability. The number of fibres for a particular weight should be determined by experiment; sixteen fibres of the silk supplied to the Makerstoun Observatory, and bearing nearly a pound weight, were found insufficient several times, though that number was recommended in the Report of the Royal Society; this was probably due to some difference in the thread: a thread of 22 fibres has now performed well for seven years.

I should notice that M. NERVANDER has proposed to form the suspension thread, by moistening with hot water the fibre cut into lengths, and submitting each length in this state to a considerable tension, before combining them to form the thread.

The Bifilar Magnetometer.—The chief source of error for this instrument is also to be found in its suspension; wires of silver or of gold have generally been adopted; although threads like those for the declinometer have also been employed, as at Greenwich. I object to the use of skeins, not merely because the errors due to a silk suspension are probably greater than those due to wires, but chiefly because no correction can be applied for the errors due to the former, while those due to the latter can be wholly eliminated. One error common to every kind of suspension is due to the stretching of the thread or wires, which gives a false value of the secular change; it is curious that no attempt has been made to eliminate this error, which could easily be done by means of a small apparatus for measuring the distance between the suspended magnet and the base plate of instrument. Any twist in the wires will give a false value of the unit coefficient, if determined in the usual way by the torsion circle; I am afraid that there is an equal chance of a similar error with silk threads, besides the probable variation due to breaking of fibres, &c. The error arising from twist, however, does not appear, when the process, which I have proposed and used, of determining the unit coefficient by deflections is adopted. The error which is peculiar to the wire suspension is that already noticed of a variation due to temperature; this error, however, also disappears when the temperature coefficient is determined by my process, since then, the total effect of temperature upon the position of the magnet is at once obtained. There remains against the silk suspension the heavy and indeterminable errors due to humidity, and to the gradual breaking of fibres.

By the use of metallic wires and an apparatus to determine the amount which they stretch, nothing is required to render this instrument as perfect as possible but a magnet with permanent magnetism, the proper processes being employed for the determinations of the unit and temperature coefficients.

The Balance Magnetometer.—I conceive that with proper care this apparatus may give considerably better results than have ever yet been obtained from it.

The points of principal consequence are, well made hardened knife edges, and a magnet that will not lose magnetism. The temperature coefficients of well hardened thin bars, especially of those supplied by Robinson, have been very small; and it would not be difficult for the maker, by a few experiments, to diminish or destroy the effect of temperature altogether in the manner suggested afterwards. The only subject then remaining for the maker's skill would be the formation of a powerful and *permanent* magnet with a hard well-made knife-edge. I have already shown in other places, than no dependence can be placed on the coefficients involving the time of vibration of this needle.

Mechanical Temperature Compensation.—The difficulties connected with the diminution of the temperature coefficients of magnets, for the purposes of the bifilar and balance magnetometers, may be, to a great extent, avoided by mechanical compensations. Such compensations, by a little experimentation and previous calculation, may be sufficiently complete for most self-registering apparatuses, to render considerations of the varying temperature negligible: even for the more delicate apparatuses, however, any incompleteness of the temperature compensation may be determined by the process which I have employed. The following method of compensation may be adopted for the bifilar magnet:—Let the upper extremities of the suspension wires be attached to the ends of two brass rods, which approach each other within an interval equal to the diameter of the lower wheel, and let the other ends of the brass rods be *fixed* to a beam of wood, so that an increase of temperature will cause the free ends of the rods to approach each other, by an amount equal to the difference of their expansion and that of the wooden beam to which they are fixed. Such an approximation will diminish the directive force of the wires, and by a proper regulation will compensate for the diminution of the magnet's moment. If the suspended wires are silver, and the lower wheel is of brass, the coefficient (e) of *contraction* of the space betwixt the suspension wires at the top will be found from the equation of equilibrium to be

$$e = q$$

where q is the temperature coefficient. Thus, in the case of the Makerstoun bifilar $q = 0{\cdot}000266$, the interval of the wires is nearly 0·5 inch, and, therefore, the brass rods would require each to be about $7\frac{1}{2}$ inches long, in order that the interval be diminished 0·000266 of itself, or 0·000133 inch; the difference of the coefficients of expansion of brass and wood being assumed $= 0{\cdot}0000085$. Magnets with a temperature co-efficient of 0·0001 would require brass suspension rods of3 inches in length, or less in proportion as the interval of the wires is less than 0·5 inch.

For the balance magnet; let a brass rod be fixed to the magnet near its south end, but free to expand towards the north, and having as much to the north of the axle as to the south; it is obvious that when the temperature increases the

expansion of the brass rod towards the north, if properly regulated, may be made to depress the north end of the needle as much as the diminution of the magnetic moment would tend to elevate it. The expression for the proper weight and length of such a brass rod is more complicated than in the case of the bifilar, depending on the weight of the needle, and the distance of its centre of gravity from the centre of motion. In the case of the Makerstoun balance, for which $q=0{\cdot}00008$, I have computed that a brass rod 10 inches long, $\frac{1}{30}$ the weight of the needle, fixed so that its centre of gravity should be near the centre of motion of the needle, would by its expansion compensate nearly for the diminution of the magnetic moment.

In both cases such computations could only be considered as rough guides to the instrument-maker who, by a few experiments at different temperatures, might be able to attain a more accurate compensation.

Magnets.—My experience of small magnets is not very great, but I feel inclined to prefer thin parallelopipedal magnets of a length of about six inches for variation instruments in a fixed observatory, to either the large or smaller sizes. If building them of thin bars would diminish the temperature coefficient, would the compound magnet be equally permanent? For variation instruments, mirrors and scales would be preferable to collimators for such small magnets.

The whole subject of the best forms and kinds of magnets, the best for permanency, intensity, and smallness of temperature co-efficient, requires a careful investigation. I am not aware whether any considerable use has been made of the labours of the Rev. Dr Scoresby, Mr Petrie, and others, for the purposes of an observatory.

Instruments for Absolute Determinations.—These instruments require to be placed at a distance from the others, and in a place wholly free from iron.

The Inclinometer.—This should have the needle placed apart from the reading circle, and as little metal should be employed as possible for the base: if the makers would take greater pains in obtaining metal without iron, such precautions would be less necessary. Such instruments as those made by M. Repsold of Hamburgh, with reading microscopes and short needles, seem best fitted for good observations.

In order to determine the error of old instruments due to the iron in the circle or general structure, the following process might be employed with advantage: Connect the needle with a beam carrying a lens and scale, or a mirror, with the scale at a distance,—suspend this by a silk thread so that the axle of the needle may occupy its usual position in the circle, the latter with the whole

apparatus being placed horizontal and the agate planes being removed, adjust a telescope so as to read the scale, and turn the circle, &c., round, so that a given division shall occupy different azimuths; then from the variations of scale reading (the changes of declination being subducted), the effect of the circle, &c., upon the needle in different positions is determined; and from these the effect upon the needle, when the whole apparatus is vertical, may be easily obtained. This process will be found much more satisfactory then than that by vibrations. I would only farther suggest, that the process should be repeated, with the poles changed, and that the position of the needle should be obtained for the apparatus away; since in some needles I have found that the intensity of saturation differs with the end which is made north, and that one end is sometimes much weaker than the other.

The Horizontal Force-Measurer.—For a fixed observatory, I feel inclined to prefer thin parallelopipedal magnets, perhaps about 8 inches long, with deflections of from 3° to 8° according to M. Gauss's method, rather than the small magnets and large deflections by Dr Lamont's. If, however, the 4-inch magnets are used I prefer a modification of Dr Lamont's method which Dr Lloyd has employed, in which the deflecting bar is kept always at right angles, not to the suspended magnet, but to the magnetic meridian. This subject requires considerable examination; the discordant results obtained from different instruments, and from the same instrument with different magnets, are too considerable not to require explanation. The deflecting magnet should never be touched with the hand during observations, but it should be lifted by a carriage or chair. The expansion of the distance beam should not be omitted in the computation of the absolute intensity; where it is of brass the effect of this omission may be quite marked in comparing observations during summer and during winter. I may touch upon the whole subject again in another way.

Having noticed those points which have occurred to me as of principal importance, or as more or less new, I cannot conclude this report without adverting to the assistance which I have received from different gentlemen during my labours at Makerstoun.

To yourself I have been especially indebted. The foundation and support of the observatory is a thing, of itself, which might be noticed as a matter for gratulation. It is rare for persons with much more extensive means to have done so much for science,—while they were themselves living and capable of otherwise employing their wealth—it is rare for them to have done so much even by their bequests. This reason for thanks I possess only in common with other lovers of science. It is for your personal kindness, the friendship with which you have honoured me, the suggestions and aids which I have derived from you

in every matter likely to advance the cause that you have had so much at heart, and which were likely to enable me to perform those duties devolving upon me with satisfaction and comfort to myself,—it is for these, and many similar kindnesses, that I have to offer you my most grateful and most hearty thanks.

You have acknowledged, in the first part of the Makerstoun Observations, the assistance which you derived from the advice of Professor J. D. Forbes as to the formation and continuance of the Makerstoun Observatory, and I have to acknowledge my obligations to him in a more extensive way. As his pupil I am indebted to him for his valuable instructions, and especially for that love of strict science which he has sought with so much success to diffuse among his students in the University of our Scottish metropolis, whether by his prelections or by his example, through those original and laborious scientific investigations which he has prosecuted so successfully. In some of the latter of these I had the pleasure and good fortune to assist him, benefiting as I hope I did, by that cautious and careful spirit which distinguishes his researches. Besides many other kindnesses, I owe to his recommendation your selection of me for the care of your observatory: since then, I have been in constant communication with him, either as my friend and adviser, or in his capacity as secretary of the Royal Society of Edinburgh, in whose Transactions the work of your observatory has appeared.

To the Rev. Dr H. Lloyd, the excellent President of the Royal Irish Academy, I also owe my best acknowledgments. It was to him that the observatory owed its first scheme of observation, and much attention and examination of the earliest observations. I have also been indebted to him in frequent communications, and, above all, to his published papers on the instruments and processes of observatory work, without the use of which my own progress, and that of most of the Directors of our Colonial Observatories, would have been difficult and painful labour.

Mr Airy, the Astronomer Royal, I have before thanked for the instruction which I received in the Greenwich Observatory before undertaking the charge of yours; but I have also to thank him for the readiness and willingness with which he has invariably thrown open to me any matter connected with the observations at Greenwich, which I may have desired for comparison with our own.

I have already noticed the valuable grant of the Royal Society of Edinburgh towards the printing of the volumes of Observations. I may also notice that copies of the volumes of Makerstoun Observations have been forwarded by the Royal Society to the institutions and individuals, given in the Addendum to this Report, in addition to those entitled to receive them as portions of the Edinburgh Transactions.

Permit me to conclude by expressing my hope that these labours, to which

I have devoted my best energies, may ultimately be found to have added something of importance to our knowledge of the wondrous works of that Infinite Being, the Creator of all things and the Redeemer of men.

And I have the honour to be,

SIR,

Your very obedient,

And very humble servant.

JOHN ALLAN BROUN.

EDINBURGH, *July* 1850.

ADDENDUM.

Besides those Institutions and Individuals entitled to receive the Edinburgh Transactions, the following have had the Makerstoun Observations forwarded to them:—

ENGLAND.

The Royal Observatory, *Greenwich.*
The Cambridge Observatory.
The Oxford Observatory.
The Durham Observatory.
The Royal Artillery Library, *Woolwich.*
The Trigonometrical Survey Office, *London.*
Colonel Sabine, *Woolwich.*
Captain Riddell.
Very Rev. Dr Peacock, *Ely.*
Rev. Dr Whewell, *Cambridge.*
S. H. Christie, Esq., *Woolwich.*
W. S. Harris, Esq., *Plymouth.*

SCOTLAND.

The Royal Observatory, *Edinburgh.*
The Glasgow Observatory.

IRELAND.

The Dublin Observatory.
The Armagh Observatory.
Rev. Dr Lloyd, *Dublin.*
The Earl of Rosse, *Parsonstown.*
E. J. Cooper, Esq., *Markree.*

COLONIES, ETC.

St Helena, Magnetic Observatory.
Cape of Good Hope, Observatory.
Cape of Good Hope, Magnetic Observatory.
Madras, Observatory.
Bombay, Magnetic Observatory.
Trevandrum, Magnetic Observatory.
Paramatta, N. S. W., Observatory.
Toronto, Canada, Magnetic Observatory.

CONTINENT OF EUROPE.

Berlin, M. Dove.
Berlin, M. Erman.
Bonn, Observatory.
Breslau, Observatory.
Cadiz, Observatory.
Dorpat, M. Kämtz.
Geneva, Observatory.
Helsingfors, Magnetic Observatory.
Kasan, Observatory.
Lausanne, M. Wartmann.
Milan, Observatory.
Naples, Observatory.
Paris, Observatory.
Prague, Observatory.
Pulkowa, Observatory.
Rome, Observatory Collegio Romano.
Senftenberg (Bohemia), Observatory.
St Petersburg, Corps des Mines.
Vienna, Observatory.

UNITED STATES.

Boston, Harford Magnetic Observatory.
Philadelphia, Girard College Magnetic Observatory.
Washington, Observatory.